TABLES

FOR

STEEL

DETAILING & DESIGNING

BY

J.A. AURINGER, C.E.

LIBRARY
758466
UNIVERSITY OF TORONTO

PLEASE RETURN TO
DEPT. of APPLIED MECHANICS

I Broad Flange Columns.

Toronto By-Law 6401

Less than 50 R – S = 13000 A – Between 50 R + 120 R – S = A (15500 – 50 L/R)

J. H. Symons. November 1913

Dimensions of Column	Weight	Area	Least Radius of gyration	Length of Column between Lateral Supports in Feet															
Inches	lbs.	Sq in	Inches	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20
4 × 4	13.6	4.0	.94	25.8	24.6	23.3	22.0	20.7	19.5										
5 1/8 × 4 1/2	17.5	5.25	1.11	34.1	33.5	32.1	30.7	29.3	27.9	26.5	25.0								
5 × 5	18.7	5.5	1.16	35.7	35.5	34.0	32.6	31.2	29.8	28.3	26.9								
6 1/8 × 5 1/8	23.5	7.0	1.25	45.5	45.5	44.1	42.4	40.8	39.1	37.4	35.7	34.0							
8 × 6	29.0	8.6	1.34	55.9	55.9	55.1	53.1	51.2	49.3	47.3	45.4	43.5	41.6						
6 × 6	23.8	7.0	1.38	45.5	45.5	45.1	43.6	42.0	40.5	39.0	37.5	35.9	34.4						
9 × 7	51.0	15.0	1.60	97.5	97.5	97.5	96.5	93.7	90.9	88.1	85.3	82.5	79.6	76.8	74.0	71.2			
7 1/8 × 7 1/8	31.5	9.3	1.67	60.4	60.4	60.4	60.3	58.7	57.0	55.3	53.6	52.0	50.3	48.6	47.0	45.3			
8 × 8	34.6	10.17	1.79	66.1	66.1	66.1	66.1	65.1	63.4	61.7	60.0	58.3	56.6	54.9	53.2	51.5	49.8		
7 3/8 × 7 3/8	37.0	10.91	1.86	70.9	70.9	70.9	70.9	70.4	68.7	66.9	65.2	63.4	61.6	59.9	58.1	56.4	54.6	52.8	
8 3/8 × 8 3/8	43.6	12.8	2.04	83.2	83.2	83.2	83.2	83.2	82.2	80.3	78.4	76.6	74.7	72.8	70.9	69.0	67.2	65.3	61.5
9 1/2 × 9 1/2	51.1	150	2.21	97.5	97.5	97.5	97.5	97.5	97.5	95.8	93.8	91.8	89.7	87.7	85.7	83.6	81.6	79.6	75.5
10 1/4 × 10 1/4	61.0	17.92	2.39	116.4	116.4	116.4	116.4	116.4	116.4	116.3	114.1	111.8	109.6	107.3	105.1	102.8	100.6	98.3	93.9
12 × 12	80.23	23.58	2.76	153.2	153.2	153.2	153.2	153.2	153.2	153.2	153.2	151.9	149.4	146.8	144.3	141.7	139.1	136.6	131.4

For Columns 8" x 8" and greater see Bethlehem

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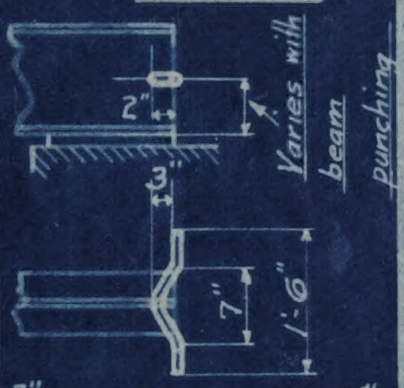
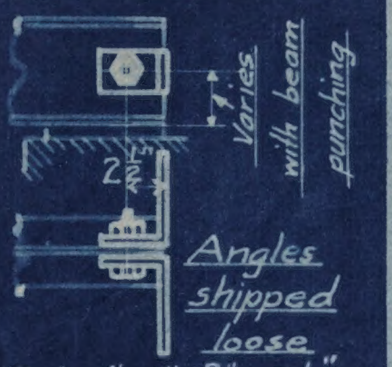
ANCHORS - TIES

GOVERNMENT ANCHOR



$\frac{3}{4}$" ϕ Rod - 1'-9" Wt. 3#

ANGLE ANCHOR

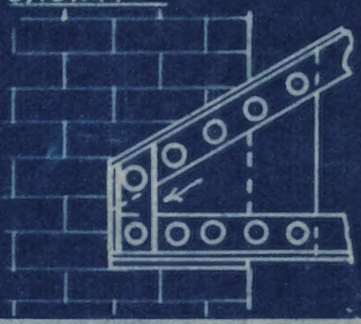


Angles shipped loose

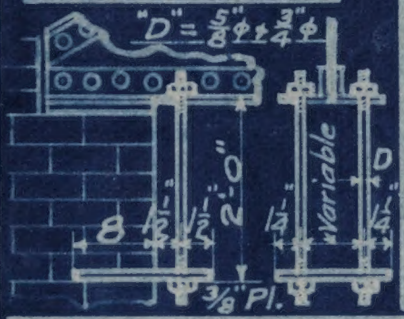
2-Ls 6"-4"-$\frac{7}{16}$" - 2'-1"
1-Bolt ¾" ϕ
Wt. with bolts - 7#

TRUSS ANCHOR

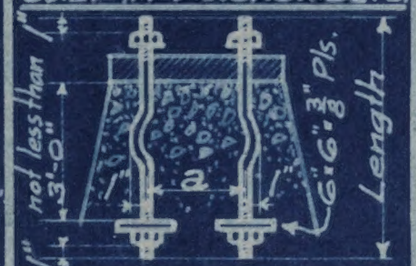
Where wall extends above truss use Angle Anchor as shown.



TRUSS ANCHOR



"BUILT IN" ANCHOR BLTS.



If "a" < 6" use "2-Hole" Wash.

SWEDGE BOLTS

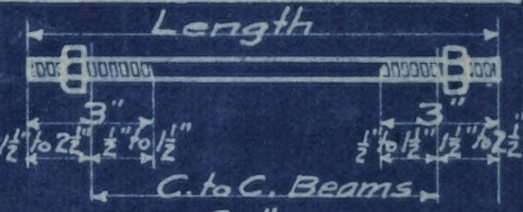
Punch holes ⅜" larger than dia Bolt. Wt. incl. nut.

Dia.	length	Wt.
¾	0'-9"	1.3
⅞	1-0	2.3
1	1-0	3.1
1¼	1-3	6.1

TIE RODS

Lengths given in Ft. & Ins's.
Weight " " Lbs.

LENGTHS FOR ⅝" - ¾" & ⅞" RODS FOR VARIOUS DISTANCES C. to C. BEAMS



Ft. \ Ins.	0"	1-2-3	4-5-6	7-8-9	10-11
1	1'-3"	1'-6"	1'-9"	2'-0"	2'-3"
2	2-3	2-6	2-9	3-0	3-3
3	3-3	3-6	3-9	4-0	4-3
4	4-3	4-6	4-9	5-0	5-3
5	5-3	5-6	5-9	6-0	6-3
6	6-3	6-6	6-9	7-0	7-3
7	7-3	7-6	7-9	8-0	8-3
8	8-3	8-6	8-9	9-0	9-3

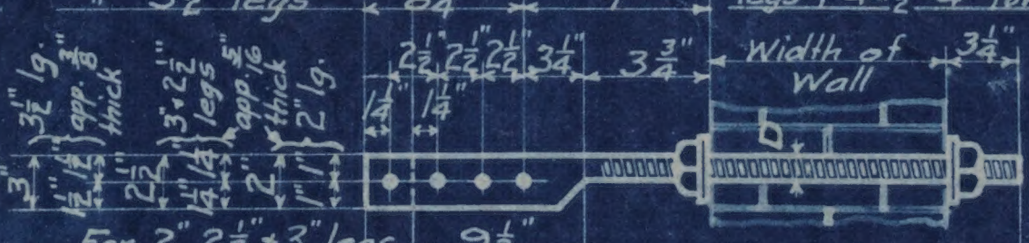
WEIGHT FOR ¾" ϕ ROD

Ft. \ Ins.	0"	1-2-3	4-5-6	7-8-9	10'-11"
1			3.4	3.8	4.2
2	4.2	4.5	4.9	5.3	5.7
3	5.7	6.0	6.4	6.8	7.2
4	7.2	7.5	7.9	8.3	8.7
5	8.7	9.0	9.4	9.8	10.2
6	10.2	10.5	10.9	11.3	11.7
7	11.7	12.0	12.4	12.8	13.2
8	13.2	13.5	13.9	14.3	14.7

WALL ENDS - These wall conns. are to be used as ties in upper or lower chords of Roof Trusscs.

For 2", 2½", +3" legs, 6¼" 7"
" 3½" legs 8¾" 7"

Washers :- 5"×½"-5" for 3½" legs ; 4"×½"-4" for all others.



For 2", 2½", +3" legs	9½"	1'-8"	13" Wall
" 3½" legs	1'-0"	2'-0"	17" "
		2'-4"	21" "
		2'-8"	25" "

Diam. "D" :- 1¼" for 3½" legs
1" " 3"+2½" legs
⅞" " 2" legs

O.K. J.A.A. 6-5-10.

A.B.Co's Standard.
As Approved:- 6-10-07.

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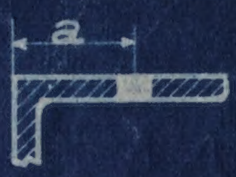
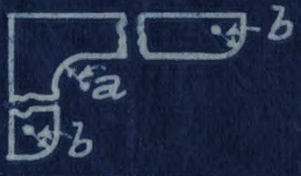
GAUGES FOR ANGLES



Length of Leg	Spacing for Flanges a	b	c	Spacing for Braces a	b	c	Diam. of Max. Rivets
8	4½	3	3				1⅛
7	4	2½	3		2	3½	1
6½		2½	2½		2	3	⅞
6	3½	2½	2¼		2	2½	"
6	3½	2¼	2½		2	2½	"
5½	3½	2¼	2		2	2¼	"
5	3	2	1¾		1¾	2	"
4½	2½	2	1¼	2¼	1¾	1½	"
4	2½			2			"
3½	2			1¾			"
3	1¾			1⅝			"
2½	1⅜						¾
2	1⅛						⅝
1¾	1						½
1½	⅞						⅜
1⅜	⅞						"
1¼	¾						"
1	⅝						¼
¾	½						"

FILLETS OF ANGLES

Radii in Inches



Size of Angles	Carnegie a	b	Size of Angles	Carnegie a	b
8" x 8"	5/8"	5/16"	8" x 6"	1/2"	1/4"
6 x 6	1/2	3/8	7 x 3½	"	5/16
4 x 4	3/8	5/16	6 x 4	"	3/8
3½ x 3½	"	"	6 x 3½	"	"
3 x 3	5/16	1/4	5 x 4	7/16	5/16
2½ x 2½	1/4	3/16	5 x 3½	"	"
2 x 2	"	"	5 x 3	3/8	"
1¾ x 1¾	"	"	4 x 3½	"	"
1½ x 1½	3/16	1/8	4 x 3	"	"
1¼ x 1¼	"	"	3½ x 3	"	"
1 x 1	1/8	"	3½ x 2½	5/16	1/4
¾ x ¾	"	"	3 x 2½	"	"
			3 x 2	"	"
			2½ x 2	1/4	3/16
			2 x 1⅜	"	"

O.K. Jan. 5-27-10

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- A.R.Co's Standard -
As Approved:- 6-10-07

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ANGLES - PENCOYD - CARNEGIE

Size	Thick'ss	PENCOYD			CARNEGIE (From C. Hand Book 1903)							
		Over Run	Wt. per Ft. in Lbs.	Area in Sq. Ins.	Wt. per Ft. in Lbs.	Area in Sq. Ins.	Dist. from C. of G. to back of Ls	Neut. Axis thro C.G. // Leg M. of Inertia I	Sec. Mod'lus S	Rad. of Gyra. r	Least Radius of Gyration	Bend. Mom. in Ft. Lbs. @16000# per □"
8"×8"	1 1/8				56.9	16.73	2.41	97.97	17.53	2.42	1.55	23400
	1 1/16				54.0	15.87	2.39	93.53	16.67	2.43	1.56	22200
	1	1/4	52.8	15.53	51.0	15.00	2.37	88.98	15.80	2.44	1.56	21100
	15/16	3/16	49.3	14.50	48.1	14.12	2.34	84.33	14.91	2.44	1.56	19900
	7/8	1/8	45.8	13.47	45.0	13.23	2.32	79.58	14.01	2.45	1.57	18700
	13/16	1/16	42.4	12.47	42.0	12.34	2.30	74.71	13.11	2.46	1.57	17500
	3/4	0	39.0	11.47	38.9	11.44	2.28	69.74	12.18	2.47	1.57	16200
	11/16	3/16	36.6	10.76	35.8	10.53	2.25	64.64	11.25	2.48	1.58	15000
	5/8	1/8	33.2	9.76	32.7	9.61	2.23	59.42	10.30	2.49	1.58	13700
	9/16	1/16	29.8	8.76	29.6	8.68	2.21	54.09	9.34	2.50	1.58	12500
	1/2	0	26.4	7.76	26.4	7.75	2.19	48.63	8.37	2.50	1.58	11200
6"×6"	1				37.4	11.00	1.86	35.46	8.57	1.80	1.16	11400
	15/16	1/4	35.6	10.73	35.3	10.37	1.84	33.72	8.11	1.80	1.16	10800
	7/8	3/16	33.1	10.03	33.1	9.74	1.82	31.92	7.64	1.81	1.17	10200
	13/16	1/8	31.2	9.32	31.0	9.09	1.80	30.06	7.15	1.82	1.17	9550
	3/4	1/16	28.7	8.60	28.7	8.44	1.78	28.15	6.66	1.83	1.17	8900
	11/16	0	26.5	7.79	26.5	7.78	1.75	26.19	6.17	1.83	1.17	8250
	5/8	1/4	24.4	7.32	24.2	7.11	1.73	24.16	5.66	1.84	1.18	7550
	9/16	3/16	21.9	6.60	21.9	6.43	1.71	22.07	5.14	1.85	1.18	6850
	1/2	1/8	19.6	5.88	19.6	5.75	1.68	19.91	4.61	1.86	1.18	6150
	7/16	1/16	17.3	5.09	17.2	5.06	1.66	17.68	4.07	1.87	1.19	5450
	3/8	0	14.8	4.35	14.9	4.36	1.64	15.39	3.53	1.88	1.19	4700
4"×4"	13/16				19.9	5.84	1.29	8.14	3.01	1.18	.77	4010
	3/4	1/4	19.5	5.73	18.5	5.44	1.27	7.67	2.81	1.19	.77	3750
	11/16	3/16	17.7	5.20	17.1	5.03	1.25	7.17	2.61	1.19	.77	3480
	5/8	1/8	16.0	4.70	15.7	4.61	1.23	6.66	2.40	1.20	.77	3200
	9/16	1/16	14.5	4.26	14.3	4.18	1.21	6.12	2.19	1.21	.78	2920
	1/2	0	12.8	3.76	12.8	3.75	1.18	5.56	1.97	1.22	.78	2630
	7/16	1/8	11.3	3.32	11.3	3.31	1.16	4.97	1.75	1.23	.78	2330
	3/8	1/16	9.8	2.88	9.8	2.86	1.14	4.36	1.57	1.23	.79	2030
	5/16	0	8.2	2.41	8.2	2.40	1.12	3.71	1.29	1.24	.79	1720

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ANGLES - PENCOYD - CARNEGIE

SIZE	THICK'SS	PENCOYD			CARNEGIE (From C. Hand Book 1903)							
		Over Run	Wt. per Ft. in Lbs.	Area in Sq. Ins.	Wt. per Ft. in Lbs	Area in Sq. Ins.	Dist. from C. of G. to back of Ls	Neut. Axis thro C.G. ∥ Leg			Least Radius of Gyration	Bend. Mom. in Ft. Lbs @16000# per □"
								Mom. Inertia I	Sec. Modlus S	Rad. of Gyra r		
3½" × 3½"	13/16				17.1	5.03	1.17	5.25	2.25	1.02	.67	3000
	3/4				16.0	4.69	1.15	4.96	2.11	1.03	.67	2810
	11/16				14.8	4.34	1.12	4.65	1.96	1.04	.67	2610
	5/8	1/8	13.9	4.09	13.6	3.98	1.10	4.33	1.81	1.04	.67	2410
	9/16	1/16	12.5	3.68	12.4	3.62	1.08	3.99	1.65	1.05	.68	2200
	1/2	0	11.1	3.26	11.1	3.25	1.06	3.64	1.49	1.06	.68	1990
	7/16	1/8	9.9	2.91	9.8	2.87	1.04	3.26	1.32	1.07	.68	1760
	3/8	1/16	8.5	2.50	8.5	2.48	1.01	2.87	1.15	1.07	.69	1530
	5/16	0	7.1	2.09	7.2	2.09	.99	2.45	.98	1.08	.69	1310
3" × 3"	5/8				11.5	3.36	.98	2.62	1.30	.88	.57	1730
	9/16				10.4	3.06	.95	2.43	1.19	.89	.58	1590
	1/2				9.4	2.75	.93	2.22	1.07	.90	.58	1430
	7/16				8.3	2.43	.91	1.99	.95	.91	.58	1270
	3/8				7.2	2.11	.89	1.76	.83	.91	.58	1110
	5/16				6.1	1.78	.87	1.51	.71	.92	.59	950
	1/4				4.9	1.44	.84	1.24	.58	.93	.59	770
2½" × 2½"	1/2	5/16	7.8	2.29	7.7	2.25	.81	1.23	.73	.74	.47	970
	7/16	1/4	6.9	2.03	6.8	2.00	.78	1.11	.65	.74	.48	870
	3/8	3/16	5.9	1.74	5.9	1.73	.76	.98	.57	.75	.48	760
	5/16	1/8	5.0	1.47	5.0	1.47	.74	.85	.48	.76	.49	640
	1/4	1/16	4.1	1.21	4.1	1.19	.72	.70	.40	.77	.49	530
	3/16	0	3.1	.91	3.1	.90	.69	.55	.30	.78	.49	400

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Angles marked * are special and their use should be avoided.

ANGLES – PENCOYD - CARNEGIE

Size	Thick'ss	PENCOYD			CARNEGIE (From C. Hand Book 1903)							
		Over Run	Wt per Ft. in Lbs.	Area in Sq. Ins.	Wt. per Ft. in Lbs.	Area in Sq. Ins.	Dist. from C. of G. to back of L's	Neut. Axis thro C.G. ∥ Leg M. of Inertia I	Sec. Mod'us S	Rad. of Gyr. r	Least Radius of Gyration	Bend. Mom. in Ft Lbs @16000* per □
2" × 2"	7/16				5.3	1.56	.66	.54	.40	.59	.39	530
	3/8	3/16	4.8	1.41	4.7	1.36	.64	.48	.35	.59	.39	470
	5/16	1/8	4.0	1.18	4.0	1.15	.61	.42	.30	.60	.39	400
	1/4	1/16	3.2	.94	3.2	.94	.59	.35	.25	.61	.39	330
	3/16	0	2.5	.74	2.5	.72	.57	.28	.19	.62	.40	250
3" × 1 1/4"	7/16				4.6	1.30	.59	.35	.30	.51	.33	400
	3/8	3/16	4.1	1.21	4.0	1.17	.57	.31	.26	.51	.34	350
	5/16	1/8	3.5	1.03	3.4	1.00	.55	.27	.23	.52	.34	310
	1/4	1/16	2.8	.82	2.8	.81	.53	.23	.19	.53	.34	250
	3/16	0	2.1	.62	2.8	.62	.51	.18	.14	.54	.35	190
1 1/2" × 1 1/2"	3/8	1/4	3.5	1.03	3.4	.99	.51	.19	.19	.44	.29	250
	5/16	3/16	2.9	.85	2.9	.84	.49	.16	.162	.44	.29	220
	1/4	1/8	2.4	.71	2.4	.69	.47	.14	.134	.45	.29	180
	3/16	1/16	1.8	.53	1.8	.53	.44	.11	.104	.46	.29	140
	1/8	0	1.2	.35	1.3	.36	.42	.08	.070	.46	.30	90
1 1/4" × 1 1/4"	5/16				2.4	.69	.42	.09	.109	.36	.23	150
	1/4		2.0	.59	2.0	.56	.40	.077	.091	.37	.24	120
	3/16		1.5	.44	1.5	.43	.38	.061	.071	.38	.24	90
	1/8		1.0	.29	1.1	.30	.35	.044	.049	.38	.25	70
*1" × 1"	1/4		1.5	.44	1.5	.44	.34	.037	.056	.29	.19	70
	3/16		1.2	.35	1.2	.34	.32	.030	.044	.30	.19	60
	1/8		.8	.24	.8	.24	.30	.022	.031	.31	.20	40
*3/4" × 3/4"	3/16				.9	.25	.26	.012	.024	.22	.16	32
	1/8				.6	.17	.23	.009	.017	.23	.17	23

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ANGLES - PENCOYD - CARNEGIE

(From C. Hand Book 1903)

Size	Thick'ss	PENCOYD Over Run	PENCOYD Wt. per Ft. in Lbs.	PENCOYD Area in Sq. Ins.	CARNEGIE Wt. per Ft. in Lbs	CARNEGIE Area in Sq. Ins.	Perp. Dist. C.G. to B.L. in Ins. x_1	Perp. Dist. C.G. to B.L. in Ins. x_2	Mom. of Inertia Axis A-B	Mom. of Inertia Axis C-D	Sect. Modulus Axis A-B	Sect. Modulus Axis C-D	Rad. of Gyration Axis A-B	Rad. of Gyration Axis C-D	Rad. of Gyration Axis E-F	Max. Bend M. in Ft. lbs @ 16000# per □ Long Leg Vert	Max. Bend M. in Ft. lbs @ 16000# per □ Sht Leg Vert
* 8" × 6"	1	1/2	46.7	13.73	44.4	13.06	1.65	2.65	38.78	80.78	8.92	15.11	1.73	2.49	1.28	20200	11900
	15/16	7/16	43.6	12.87	42.0	12.35	1.63	2.63	36.85	76.59	8.43	14.27	1.73	2.50	1.28	19000	11250
	7/8	3/8	40.6	11.94	39.5	11.62	1.61	2.61	34.86	72.31	7.94	13.41	1.74	2.51	1.28	17900	10600
	13/16	5/16	37.6	11.06	36.6	10.76	1.59	2.59	32.82	67.92	7.44	12.55	1.75	2.52	1.29	16700	9900
	3/4	1/4	34.6	10.17	33.8	9.94	1.56	2.56	30.72	63.42	6.93	11.67	1.76	2.53	1.29	15600	9250
	11/16	3/16	31.7	9.32	31.7	9.32	1.54	2.54	28.56	58.82	6.40	10.77	1.77	2.54	1.29	14400	8550
	5/8	1/8	28.8	8.47	28.7	8.44	1.52	2.52	26.33	54.10	5.88	9.87	1.77	2.54	1.30	13200	7850
	9/16	1/16	25.8	7.59	26.0	7.65	1.50	2.50	24.04	49.26	5.34	8.95	1.78	2.55	1.30	11900	7100
	1/2	0	23.0	6.76	23.0	6.75	1.47	2.47	21.68	44.31	4.79	8.02	1.79	2.56	1.30	10700	6400
* 7" × 3½"	1	5/16	34.0	10.00	32.3	9.50	.96	2.71	7.53	45.37	2.96	10.58	.89	2.19	.88	14100	3950
	15/16	1/4	31.6	9.29	30.5	8.97	.94	2.69	7.18	43.13	2.80	10.00	.89	2.19	.88	13350	3740
	7/8	3/16	29.4	8.64	28.7	8.42	.92	2.67	6.83	40.82	2.64	9.42	.90	2.20	.88	12550	3520
	13/16	1/8	27.2	8.02	26.8	7.87	.89	2.64	6.46	38.45	2.48	8.82	.91	2.21	.88	11750	3310
	3/4	1/16	25.0	7.35	24.9	7.31	.87	2.62	6.08	35.99	2.31	8.22	.91	2.22	.86	10950	3080
	11/16	0	23.0	6.75	23.0	6.75	.85	2.60	5.69	33.47	2.14	7.60	.92	2.23	.89	10150	2850
	5/8	3/16	21.4	6.31	21.0	6.17	.82	2.57	5.28	30.86	1.97	6.97	.93	2.24	.89	9300	2630
	9/16	1/8	19.3	5.68	19.1	5.59	.80	2.55	4.86	28.18	1.80	6.33	.93	2.25	.89	8450	2400
	1/2	1/16	17.1	5.05	17.0	5.00	.78	2.53	4.41	25.41	1.62	5.68	.94	2.25	.89	7550	2160
	7/16	0	15.0	4.40	15.0	4.40	.75	2.50	3.95	22.56	1.47	5.01	.95	2.26	.89	6700	1960
6" × 4"	1				30.6	9.0	1.17	2.17	10.75	30.75	3.79	8.02	1.09	1.85	.85	10700	5050
	15/16	3/8	30.5	8.97	28.9	8.50	1.14	2.14	10.26	29.26	3.59	7.59	1.10	1.86	.85	10100	4790
	7/8	5/16	28.6	8.41	27.2	7.99	1.12	2.12	9.75	27.73	3.39	7.15	1.11	1.86	.86	9550	4520
	13/16	1/4	26.4	7.76	25.4	7.47	1.10	2.10	9.23	26.15	3.18	6.70	1.11	1.87	.86	8950	4240
	3/4	3/16	24.4	7.18	23.6	6.94	1.08	2.08	8.68	24.51	2.97	6.25	1.12	1.88	.86	8350	3960
	11/16	1/8	22.2	6.53	21.8	6.41	1.06	2.06	8.11	22.82	2.76	5.78	1.13	1.89	.86	7700	3680
	5/8	1/16	20.2	5.94	20.0	5.86	1.03	2.03	7.52	21.07	2.54	5.31	1.13	1.90	.86	7100	3390
	9/16	0	18.1	5.32	18.1	5.31	1.01	2.01	6.91	19.26	2.31	4.83	1.14	1.90	.87	6450	3080
	1/2	1/8	16.5	4.85	16.2	4.75	.99	1.99	6.27	17.40	2.08	4.33	1.15	1.91	.87	5750	2770
	7/16	1/16	14.3	4.21	14.3	4.18	.96	1.96	5.60	15.46	1.85	3.83	1.16	1.92	.87	5100	2470
	3/8	0	12.2	3.60	12.3	3.61	.94	1.94	4.90	13.07	1.60	3.32	1.17	1.93	.88	4450	2140

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ANGLES - PENCOYD - CARNEGIE

(From C. Hand Book 1903)

Size	Thickness	Pencoyd			Carnegie				I		S		r			Max. Bend. M. in Ft. lbs @16000# per □"		Max. Bend. M. in Ft. lbs @16000# per □"	
		Over Run	Wt. per Ft. in Lbs	Area in Sq. Ins.	Wt. per Ft. in Lbs	Area in Sq. Ins.	Perp. Dist. C.G. to bL in Ins. x_1	Perp. Dist. C.G. to bL in Ins. x_2	Mom. of Inertia Axis A-B	Mom. of Inertia Axis C-D	Sect. Mod'l Axis A-B	Sect. Mod'l Axis C-D	Rad. of Gyration Axis A-B	Rad. of Gyration Axis C-D	Rad. of Gyration Axis E-F	Long Leg Vert.		Short Leg Vert.	
* 6" x 3½"	1				28.9	8.50	1.01	2.26	7.21	29.24	2.90	7.83	.92	1.85	.74	10450		3870	
	15/16	3/8	29.0	8.53	27.3	8.03	.99	2.24	6.88	27.84	2.74	7.41	.93	1.86	.74	9900		3650	
	7/8	5/16	27.0	7.94	25.7	7.55	.97	2.22	6.55	26.38	2.59	6.98	.93	1.87	.75	9300		3450	
	13/16	1/4	25.0	7.35	24.0	7.06	.95	2.20	6.20	24.89	2.43	6.55	.94	1.88	.75	8750		3240	
	3/4	3/16	23.0	6.76	22.4	6.56	.93	2.18	5.84	23.34	2.27	6.10	.94	1.89	.75	8150		3030	
	11/16	1/8	20.9	6.15	20.6	6.06	.90	2.15	5.47	21.74	2.11	5.65	.95	1.89	.75	7550		2810	
	5/8	1/16	19.0	5.59	18.9	5.55	.88	2.13	5.08	20.08	1.94	5.19	.96	1.90	.75	6900		2590	
	9/16	0	17.1	5.03	17.1	5.03	.86	2.11	4.67	18.37	1.77	4.72	.96	1.91	.75	6300		2360	
	1/2	1/8	15.6	4.60	15.3	4.50	.83	2.08	4.25	16.59	1.59	4.24	.97	1.92	.76	5650		2120	
	7/16	1/16	13.5	3.97	13.5	3.97	.81	2.06	3.81	14.76	1.41	3.75	.98	1.93	.76	5000		1880	
	3/8	0	11.6	3.41	11.7	3.42	.79	2.04	3.39	12.86	1.23	3.25	.99	1.94	.77	4350		1640	
* 5" x 4"	7/8				24.2	7.11	1.21	1.71	9.23	16.42	3.31	4.99	1.14	1.52	.84	6650		4410	
	13/16				22.7	6.65	1.18	1.68	8.74	15.54	3.11	4.69	1.15	1.53	.84	6250		4150	
	3/4	3/16	21.9	6.44	21.1	6.19	1.16	1.66	8.23	14.60	2.90	4.37	1.15	1.54	.84	5830		3870	
	11/16	1/8	19.8	5.82	19.5	5.72	1.14	1.64	7.70	13.62	2.69	4.05	1.16	1.54	.84	5400		3590	
	5/8	1/16	17.9	5.26	17.8	5.23	1.12	1.62	7.14	12.61	2.48	3.73	1.17	1.55	.84	4970		3310	
	9/16	0	16.2	4.76	16.2	4.75	1.10	1.60	6.56	11.55	2.26	3.39	1.18	1.56	.85	4520		3010	
	1/2	1/8	14.8	4.35	14.5	4.25	1.07	1.57	5.96	10.46	2.04	3.05	1.18	1.57	.85	4070		2720	
	7/16	1/16	12.8	3.76	12.8	3.75	1.05	1.55	5.32	9.32	1.81	2.70	1.19	1.58	.85	3600		2420	
	3/8	0	11.0	3.24	11.0	3.23	1.03	1.53	4.67	8.14	1.57	2.34	1.20	1.59	.86	3120		2090	
5" x 3½"	7/8				22.7	6.67	1.04	1.79	6.21	15.67	2.52	4.88	.96	1.53	.75	6510		3360	
	13/16				21.3	6.25	1.02	1.77	5.89	14.81	2.37	4.58	.97	1.54	.75	6110		3160	
	3/4	1/4	20.9	6.15	19.8	5.81	1.00	1.75	5.55	13.92	2.22	4.28	.98	1.55	.75	5710		2960	
	11/16	3/16	18.9	5.56	18.3	5.37	.97	1.72	5.20	12.99	2.06	3.97	.98	1.56	.75	5290		2750	
	5/8	1/8	16.9	4.97	16.8	4.92	.95	1.70	4.83	12.03	1.90	3.65	.99	1.56	.75	4870		2530	
	9/16	1/16	15.4	4.53	15.2	4.47	.93	1.68	4.45	11.03	1.73	3.32	1.00	1.57	.75	4430		2310	
	1/2	0	13.6	4.00	13.6	4.00	.91	1.66	4.05	9.99	1.56	2.99	1.01	1.58	.75	3990		2080	
	7/16	1/8	12.1	3.56	12.0	3.53	.88	1.63	3.63	8.90	1.39	2.64	1.01	1.59	.76	3520		1850	
	3/8	1/16	10.4	3.06	10.4	3.05	.86	1.61	3.18	7.78	1.21	2.29	1.02	1.60	.76	3060		1610	
	5/16	0	8.7	2.56	8.7	2.56	.84	1.59	2.72	6.60	1.02	1.94	1.03	1.61	.76	2590		1360	

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ANGLES - PENCOYD - CARNEGIE

(From C.H. Book 1903)

Size	Thick'ss	Pencoyd			Carnegie				I		S		r			Max. Bend M. in Ft.Lbs @16000# per □"		Max. Bend M. in Ft.Lbs @16000# per □"	
		Over Run	Wt. per Ft. in Lbs.	Area in Sq.Ins.	Wt. per Ft. in Lbs.	Area in Sq.Ins.	Perp Dist C.G. to b.L in Ins. x_1	Perp Dist C.G. to b.L in Ins. x_2	Mom of Inertia Axis A-B	Mom of Inertia Axis C-D	Sect. Modlus Axis A-B	Sect. Modlus Axis C-D	Rad of Gyration Axis A-B	Rad of Gyration Axis C-D	Rad of Gyration Axis E-F	Long Leg Vert.		Sht Leg Vert.	
5" x 3"	13/16				19.9	5.84	.86	1.86	3.71	13.98	1.74	4.45	.80	1.55	.64	5930		2320	
	3/4	1/4	19.5	5.73	18.5	5.44	.84	1.84	3.51	13.15	1.63	4.16	.80	1.55	.64	5550		2170	
	11/16	3/16	17.6	5.18	17.1	5.03	.82	1.82	3.29	12.28	1.51	3.86	.81	1.56	.64	5150		2010	
	5/8	1/8	16.0	4.70	15.7	4.61	.80	1.80	3.06	11.37	1.39	3.55	.82	1.57	.64	4740		1850	
	9/16	1/16	14.4	4.24	14.3	4.18	.77	1.77	2.83	10.43	1.27	3.23	.82	1.58	.65	4310		1690	
	1/2	0	12.8	3.76	12.8	3.75	.75	1.75	2.58	9.45	1.15	2.91	.83	1.59	.65	3880		1530	
	7/16	1/8	11.4	3.35	11.3	3.31	.73	1.73	2.32	8.43	1.02	2.58	.84	1.60	.65	3440		1360	
	3/8	1/16	9.8	2.88	9.8	2.86	.70	1.70	2.04	7.37	.89	2.24	.84	1.61	.65	2990		1190	
	5/16	0	8.2	2.41	8.2	2.40	.68	1.68	1.75	6.26	.75	1.89	.85	1.61	.66	2520		1000	
4" x 3½"	13/16				18.5	5.43	1.11	1.36	5.49	7.77	2.30	2.92	1.01	1.19	.72	3900		3070	
	3/4	1/4	18.2	5.35	17.3	5.06	1.09	1.34	5.18	7.32	2.15	2.75	1.01	1.20	.72	3670		2870	
	11/16	3/16	16.5	4.85	16.0	4.68	1.07	1.32	4.86	6.86	2.00	2.56	1.02	1.21	.72	3420		2670	
	5/8	1/8	15.0	4.41	14.7	4.30	1.04	1.29	4.52	6.37	1.84	2.35	1.03	1.22	.72	3140		2460	
	9/16	1/16	13.4	3.94	13.3	3.90	1.02	1.27	4.17	5.86	1.68	2.15	1.03	1.23	.72	2870		2240	
	1/2	0	11.9	3.50	11.9	3.50	1.00	1.25	3.79	5.32	1.52	1.93	1.04	1.23	.72	2570		2030	
	7/16	1/8	10.6	3.12	10.6	3.09	.98	1.23	3.40	4.76	1.35	1.72	1.05	1.24	.72	2290		1800	
	3/8	1/16	9.1	2.68	9.1	2.67	.96	1.21	2.99	4.18	1.18	1.50	1.06	1.25	.73	2000		1570	
	5/16	0	7.7	2.26	7.7	2.25	.93	1.18	2.59	3.56	1.01	1.26	1.07	1.26	.73	1680		1350	
4" x 3"	13/16				17.1	5.03	.94	1.44	3.47	7.34	1.68	2.87	.83	1.21	.64	3830		2240	
	3/4				16.0	4.69	.92	1.42	3.28	6.93	1.57	2.68	.84	1.22	.64	3570		2090	
	11/16				14.8	4.34	.89	1.39	3.08	6.49	1.46	2.49	.84	1.22	.64	3320		1950	
	5/8	1/8	13.9	4.09	13.6	3.98	.87	1.37	2.87	6.03	1.35	2.30	.85	1.23	.64	3070		1800	
	9/16	1/16	12.5	3.68	12.4	3.62	.85	1.35	2.66	5.55	1.23	2.09	.86	1.24	.64	2790		1640	
	1/2	0	11.1	3.26	11.1	3.25	.83	1.33	2.42	5.05	1.12	1.89	.86	1.25	.64	2520		1490	
	7/16	1/8	9.9	2.91	9.8	2.87	.80	1.30	2.18	4.52	.99	1.68	.87	1.25	.64	2240		1320	
	3/8	1/16	8.5	2.50	8.5	2.48	.78	1.28	1.92	3.96	.87	1.46	.88	1.26	.64	1950		1160	
	5/16	0	7.1	2.09	7.2	2.09	.76	1.26	1.65	3.38	.74	1.23	.89	1.27	.65	1640		990	

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SIZE	THICK'SS	PENCOYD			CARNEGIE				(From C. H. Book 1903)								
		Over Run	Wt. per Ft. in Lbs	Area in Sq. Ins.	Wt. per Ft. in Lbs	Area in Sq. Ins.	Perp. Dist. C.G. to B.L. in Ins. Z-1	Perp. Dist. C.G. to B.L. in Ins. Z-2	Mom. of Inertia I Axis A-B	Mom. of Inertia I Axis C-D	Sect. Mod'lus S Axis A-B	Sect. Mod'lus S Axis C-D	Rad. of Gyration r Axis A-B	Rad. of Gyration r Axis C-D	Rad. of Gyration r Axis E-F	Max Bend. M. in Ft. Lbs @ 16000# per Sq. In. Long Leg Vert.	Max Bend. M. in Ft. Lbs @ 16000# per Sq. In. Shd. Leg Vert.
3½" × 3"	13/16				15.8	4.62	.98	1.23	3.33	4.98	1.65	2.20	.85	1.04	.62	2930	2200
	3/4				14.7	4.31	.96	1.21	3.15	4.70	1.54	2.05	.85	1.04	.62	2730	2050
	11/16				13.6	4.00	.94	1.19	2.96	4.41	1.44	1.91	.86	1.05	.62	2550	1920
	5/8				12.5	3.67	.92	1.17	2.76	4.11	1.33	1.76	.87	1.06	.62	2350	1770
	9/16				11.4	3.34	.90	1.15	2.55	3.79	1.21	1.61	.87	1.07	.62	2150	1610
	1/2				10.2	3.00	.88	1.13	2.33	3.45	1.10	1.45	.88	1.07	.62	1930	1470
	7/16				9.1	2.65	.85	1.10	2.09	3.10	.98	1.29	.89	1.08	.62	1720	1310
	3/8				7.9	2.30	.83	1.08	1.85	2.72	.85	1.13	.90	1.09	.62	1510	1130
	5/16				6.6	1.93	.81	1.06	1.58	2.33	.72	.96	.90	1.10	.63	1280	960
3½" × 2½"	11/16				12.5	3.65	.77	1.27	1.72	4.13	.99	1.85	.67	1.06	.53	2470	1320
	5/8				11.5	3.36	.75	1.25	1.61	3.85	.92	1.71	.69	1.07	.53	2280	1230
	9/16				10.4	3.06	.73	1.23	1.49	3.55	.84	1.56	.70	1.08	.53	2080	1120
	1/2	1/4	9.4	2.76	9.4	2.75	.70	1.20	1.36	3.24	.76	1.41	.70	1.09	.53	1880	1010
	7/16	3/16	8.3	2.44	8.3	2.43	.68	1.18	1.23	2.91	.68	1.26	.71	1.09	.54	1680	910
	3/8	1/8	7.2	2.12	7.2	2.11	.66	1.16	1.09	2.56	.59	1.09	.72	1.10	.54	1450	790
	5/16	1/16	6.1	1.79	6.1	1.78	.64	1.14	.94	2.19	.50	.93	.73	1.11	.54	1240	670
	1/4	0	4.9	1.44	4.9	1.44	.61	1.11	.78	1.80	.41	.75	.74	1.12	.54	1000	550
3" × 2½"	9/16				9.5	2.78	.77	1.02	1.42	2.28	.82	1.15	.72	.91	.52	1530	1090
	1/2	1/4	8.7	2.56	8.5	2.50	.75	1.00	1.30	2.08	.74	1.04	.72	.91	.52	1390	990
	7/16	3/16	7.7	2.26	7.6	2.22	.73	.98	1.18	1.88	.66	.93	.73	.92	.52	1240	880
	3/8	1/8	6.6	1.94	6.6	1.92	.71	.96	1.04	1.66	.58	.81	.74	.93	.52	1080	770
	5/16	1/16	5.5	1.62	5.6	1.62	.68	.93	.90	1.42	.49	.69	.74	.94	.53	920	650
	1/4	0	4.5	1.32	4.5	1.31	.66	.91	.74	1.17	.40	.56	.75	.95	.53	750	530
3" × 2"	1/2	1/4	7.9	2.32	7.7	2.25	.58	1.08	.67	1.92	.47	1.00	.55	.92	.43	1330	630
	7/16	3/16	6.3	2.03	6.8	2.00	.56	1.06	.61	1.73	.42	.89	.55	.93	.43	1190	560
	3/8	1/8	5.8	1.74	5.9	1.73	.54	1.04	.54	1.53	.37	.78	.56	.94	.43	1040	490
	5/16	1/16	5.0	1.47	5.0	1.47	.52	1.02	.47	1.32	.32	.66	.57	.95	.43	880	430
	1/4	0	4.1	1.21	4.1	1.19	.49	.99	.39	1.09	.25	.54	.57	.95	.43	720	330
2½" × 2"	1/2	9/16	7.0	2.06	6.8	2.00	.63	.88	.64	1.14	.46	.70	.56	.75	.42	930	610
	7/16	1/4	6.2	1.82	6.1	1.78	.60	.85	.58	1.03	.41	.62	.57	.76	.42	830	550
	3/8	3/16	5.4	1.59	5.3	1.55	.58	.83	.51	.91	.36	.55	.58	.77	.42	730	480
	5/16	1/8	4.5	1.32	4.5	1.31	.56	.81	.45	.79	.31	.47	.58	.78	.42	630	410
	1/4	1/16	3.6	1.06	3.7	1.06	.54	.79	.37	.65	.25	.38	.59	.78	.42	510	330
	3/16	0	2.7	.79	2.8	.81	.51	.76	.29	.51	.20	.29	.60	.79	.43	390	270
2" × 1½" Bulb *	1/4				2.7	.78	.37	.69	.12	.37	.12	.23	.39	.63	.30	310	160
	3/16				2.1	.60	.35	.66	.09	.24	.09	.18	.40	.63	.31	240	120

A14.072d

· A.B.Co's Standard ·

As Approved:- 3-3-08

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ONE L-STRUTS

Safe Loads in thos. of lbs. for least rad. of guration

$p = 16000^{*} - 70\frac{l}{r}$

To left of heavy line values of $\frac{l}{r}$ = or < 125

" right " " " " " = or < 150

Size of L		Length in Feet											
		3	4	5	6	7	8	9	10	11	12	13	14
6"×6"	5/8	98	93	89	83	78	73	68	63	58	53	48	43
	9/16	89	85	80	75	71	66	62	57	53	48	43	39
	1/2	80	76	72	67	63	59	55	51	47	43	39	35
	7/16	70	67	63	59	56	52	49	45	42	38	34	31
	3/8	60	57	54	51	48	45	42	34	36	33	30	27
5"×5"	9/16	71	67	62	58	53	48	44	39	35	30		
	1/2	64	60	56	52	47	43	39	35	31	27		
	7/16	56	53	49	45	42	38	35	31	27	24		
	3/8	49	46	42	39	36	33	30	27	24	21		
4×4	1/2	48	44	40	36	32	28	24					
	7/16	42	39	35	32	28	24	21					
	3/8	37	34	31	27	24	21	18					
	5/16	31	28	26	23	21	18	15					
3½"×3½"	7/16	35	32	28	25	21	18						
	3/8	31	28	25	22	19	16						
	5/16	26	23	21	18	16	13						
3"×3"	7/16	28	25	21	18	14							
	3/8	25	22	18	15	12							
	5/16	21	18	16	13	11							
	1/4	17	15	13	11	9							
2½"×2½"	5/16	16	13	11	8								
	1/4	13	11	9	7								
	3/16	10	8	7	5								
2"×2"	5/16	11	8										
	1/4	9	7										
	3/16	7	5	4									
1¾"×1¾"	1/4	7	5										
	3/16	5	4										
1½"×1½"	3/16	4											

Size of L		Length in Feet									
		3	4	5	6	7	8	9	10	11	12
6"×4"	5/8	77	71	65	59	54	48	42	36		
	9/16	70	65	59	54	49	44	39	34		
	1/2	62	58	53	49	44	39	35	30		
	7/16	55	51	47	43	39	35	31	26		
	3/8	47	44	41	37	34	30	27	23	20	
5"×3½"	1/2	50	46	42	37	33	28	24			
	7/16	45	41	37	33	29	25	21			
	3/8	39	35	32	29	25	22	18			
	5/16	32	30	27	24	21	18	15			
4"×3"	1/2	39	35	31	26	22	18				
	7/16	35	31	27	23	20	16				
	3/8	30	27	23	20	17	14				
	5/16	25	23	20	17	15	12				
3½"×3"	1/2	36	32	28	24	20					
	7/16	32	28	24	21	17					
	3/8	27	24	21	18	15					
	5/16	23	21	18	15	13					
3½"×2½"	3/8	24	21	17	14						
	5/16	20	17	15	12						
	1/4	16	14	12	10						
3"×2½"	3/8	21	18	15	12						
	5/16	18	16	13	11						
	1/4	15	13	11	8						
3"×2"	5/16	15	12	9							
	1/4	12	10	7							
2½"×2"	5/16	13	10	8							
	1/4	11	8	6							
	3/16	8	7	5							
2"×1⅜"	3/16	5									

A14.0734

A14.074 a

ALLOWABLE TENSION - 1-L

Values given in Thos. of lbs.
Unit Stresses - 16000# per □"

Net Area = Gross - t(d + 1/8")
in which "t" = thickness, "d" = diameter of rivet.

Size of L			One Hole deducted						2-Holes deducted					
			5/8" ϕ Riv.		3/4" ϕ Riv.		7/8" ϕ Riv.		5/8" ϕ Riv.		3/4" ϕ Riv.		7/8" ϕ Riv.	
	Thick	Gross Area	Net Area	Stress	Net Area	Stress	Net Area	Stress	Net Area	Stress	Net Area	Stress	Net Area	Stress
8"·8"	1	15.00									13.25	212	13.00	2.08
	7/8	13.23									11.70	187	11.48	1.84
	13/16	12.34									10.92	175	10.71	1.71
	3/4	11.44									10.13	162	9.94	1.59
	11/16	10.53									9.32	149	9.15	1.46
	5/8	9.61									8.52	136	8.36	1.34
	9/16	8.68									7.70	123	7.55	1.21
	1/2	7.75									6.88	110	6.75	1.08
6·6	7/8	9.74					8.86	142					7.99	128
	13/16	9.09					8.28	132					7.46	119
	3/4	8.44			7.78	124	7.69	123			7.13	114	6.94	111
	11/16	7.78			7.18	115	7.09	113			6.57	105	6.40	102
	5/8	7.11	6.64	106	6.56	105	6.48	104	6.17	99	6.02	96	5.86	94
	9/16	6.43	6.01	96	5.94	95	5.87	94	5.59	89	5.45	87	5.30	85
	1/2	5.75	5.37	86	5.31	85	5.25	84	5.00	80	4.87	78	4.75	76
	7/16	5.06	4.73	76	4.68	75	4.62	74	4.40	70	4.29	69	4.18	67
	3/8	4.36	4.08	65	4.03	64	3.98	64	3.80	61	3.70	59	3.61	58
4·4	1/2	3.75	3.37	54	3.31	53	3.25	52	2.99	48	2.87	46	2.75	44
	7/16	3.31	2.98	48	2.93	47	2.87	46	2.65	42	2.55	41	2.43	39
	3/8	2.86	2.58	41	2.53	41	2.48	40	2.30	37	2.20	35	2.10	34
	5/16	2.40	2.17	35	2.13	34	2.09	33	1.94	31	1.86	30	1.78	28
3½·3½	1/2	3.25	2.87	46	2.81	45	2.75	44						
	7/16	2.87	2.54	41	2.49	40	2.43	39						
	3/8	2.48	2.20	35	2.15	34	2.10	34						
	5/16	2.09	1.86	30	1.82	29	1.78	28						
3·3	7/16	2.43	2.10	34	2.05	33	1.99	32						
	3/8	2.11	1.83	29	1.78	28	1.73	28						
	5/16	1.78	1.55	25	1.51	24	1.47	24						
	1/4	1.44	1.25	20	1.22	20	1.19	19						
2½·2½	3/8	1.73	1.45	23	1.40	22								
	5/16	1.47	1.24	20	1.20	19								
	1/4	1.19	1.00	16	.97	16								
	3/16	.90	.76	12	.74	12								
2·2	5/16	1.15	.92	15										
	1/4	.94	.75	12										
	3/16	.72	.58	9										
1½·1½	1/4	.69												
	3/16	.53												

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A.B.Co's Standard.
As Approved:- 3-3-'08

ALLOWABLE TENSION - 1-L

Values given in Thos. of lbs.
Unit Stresses - 16000 per □"

Net Area = Gross − t(d + ⅛")
in which "t" = thickness; "d" = diam. of Riv.

Size of L	Thick.	Gross Area	One Hole deducted						2-Holes deducted					
			⅝" ϕ Riv.		¾" ϕ Riv.		⅞" ϕ Riv.		⅝" ϕ Riv.		¾" ϕ Riv.		⅞" ϕ Riv.	
			Net A	Stress	Net A	Stress	Net A	Stress	Net A	Stress	Net A	Stress	Net A	Stress
8×6	1	13.06									11.31	181	11.06	177
	15/16	12.35									10.71	171	10.47	168
	7/8	11.67									10.09	161	9.87	158
	13/16	10.76									9.34	149	9.13	146
	¾	9.94									8.63	138	8.44	135
	11/16	9.32									8.11	130	7.94	129
	⅝	8.44									7.35	118	7.19	115
	9/16	7.65									6.67	107	6.52	104
	½	6.75									5.88	94	5.75	92
6×4	¾	6.94			6.28	100	6.19	99			5.63	90	5.44	87
	11/16	6.41			5.81	93	5.72	92			5.20	83	5.03	80
	⅝	5.86	5.39	86	5.31	85	5.23	84	4.92	79	4.77	76	4.61	74
	9/16	5.31	4.89	78	4.82	77	4.75	76	4.47	72	4.33	69	4.18	67
	½	4.75	4.37	70	4.31	69	4.25	68	4.00	64	3.88	62	3.75	60
	7/16	4.18	3.85	62	3.80	61	3.74	60	3.52	56	3.41	55	3.30	53
	⅜	3.61	3.33	53	3.28	52	3.23	52	3.05	49	2.95	47	2.86	46
5×3½	⅝	4.92			4.37	70	4.29	69	3.98	64	3.83	61		
	9/16	4.47	4.05	65	3.98	64	3.91	63	3.63	58	3.49	56		
	½	4.00	3.62	58	3.56	57	3.50	56	3.25	52	3.12	50		
	7/16	3.53	3.20	51	3.15	50	3.09	49	2.87	46	2.76	44		
	⅜	3.05	2.77	44	2.72	44	2.67	43	2.49	40	2.39	38		
	5/16	2.56	2.33	37	2.29	37	2.25	36	2.09	33	2.01	32		
5×3	⅝	4.61			4.06	65	3.97	63	3.67	59	3.52	56		
	9/16	4.18	3.76	60	3.69	59	3.62	58	3.34	53	3.20	51		
	½	3.75	3.37	54	3.31	53	3.25	52	3.00	48	2.87	46		
	7/16	3.31	2.98	48	2.93	47	2.87	46	2.65	42	2.54	41		
	⅜	2.86	2.58	41	2.53	41	2.48	40	2.30	37	2.20	35		
	5/16	2.40	2.17	35	2.13	34	2.09	33	1.93	31	1.85	30		
4×3	½	3.25	2.87	46	2.81	45	2.75	44	2.49	40	2.37	38		
	7/16	2.87	2.54	41	2.49	40	2.43	39	2.21	35	2.11	34		
	⅜	2.48	2.20	35	2.15	34	2.10	34	1.92	31	1.82	29		
	5/16	2.09	1.86	30	1.82	29	1.78	28	1.63	26	1.55	25		
3½×3	½	3.00	2.62	42	2.56	41	2.50	40						
	7/16	2.65	2.32	37	2.27	36	2.21	35						
	⅜	2.30	2.02	32	1.97	32	1.92	31						
	5/16	1.93	1.70	27	1.66	27	1.62	26						
3½×2½	7/16	2.43	2.10	34	2.05	33								
	⅜	2.11	1.83	29	1.78	28								
	5/16	1.78	1.55	25	1.51	24								
	¼	1.44	1.25	20	1.22	20								
3×2½	⅜	1.92	1.64	26	1.59	25								
	5/16	1.62	1.39	22	1.35	22								
	¼	1.31	1.12	18	1.09	17								
3×2	⅜	1.73	1.45	23	1.40	22								
	5/16	1.47	1.24	20	1.20	19								
	¼	1.19	1.00	16	.97	16								
2½×2	5/16	1.31	1.08	17	1.04	17								
	¼	1.06	.87	14	.84	13								
	3/16	.81	.67	11	.65	10								
2×1⅜	¼	.78	.59	9										
	3/16	.60	.46	7										

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As Approved: 3-3-08

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3.2 Yakima 4-24-11

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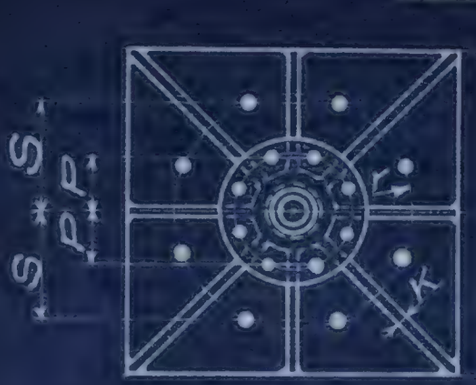
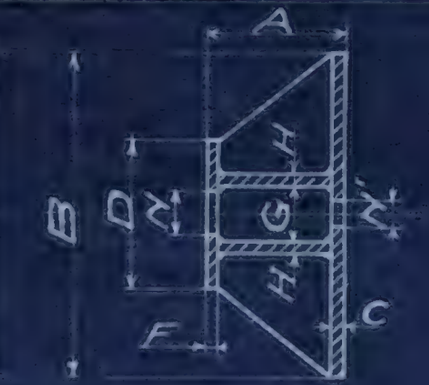
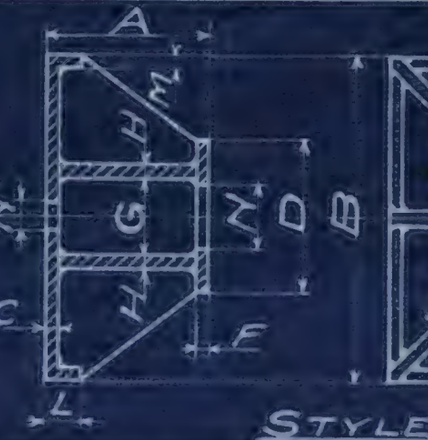
CAST IRON BASES

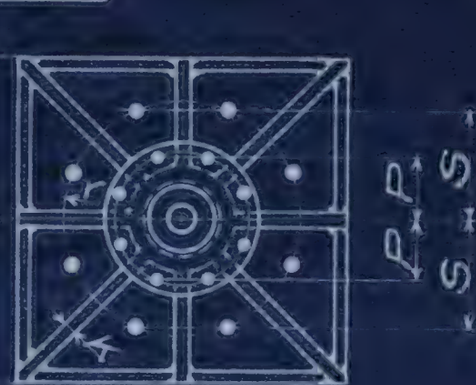
BASES FOR O · □ CAST IRON COLUMNS



STYLE "A" BASE







STYLE "B" BASE

Size Col.	Style Base	Load Tons	Height A	Base Plate B	Base Plate C	Cap Plate D	Cap Plate F	Hub G	Hub H	Ribs No.	Ribs K	Edge Flange L	Edge Flange M	Core Holes N	Core Holes N'	Cap Holes P	Base Holes r	Base Holes S	Weight lbs.
8	A		1-3	2-6	1¼	1-4	1¼	6	1⅛	8	1⅛			5	3	6	–	–	725
				2-6	1½		1½		1¼		1¼						–	–	815
				3-0	1½		1½		1¼		1¼						1-1	1-0	1040
9	A		1-3	2-6	1¼	1-4	1¼	6	1⅛	8	1⅛			5	3	6	–	–	725
				2-6	1½		1½		1¼		1¼						–	–	815
				3-0	1½		1½		1¼		1¼						1-1	1-0	1040
10	B		1-6	3-0	1½	1-5	1½	8	1½	8	1¼	4	1¼	7	3	7	1-1	1-0	1330
				3-6	1¾		1½		1½		1½		1½				1-2	1-0 15/16	1840
11	B		1-6	3-0	1½	1-5	1½	8	1½	8	1¼	4	1¼	7	3	7	1-1	1-0	1330
				3-6	1¾		1½		1½		1½		1½				1-2	1-0 15/16	1840
12	B		1-9	3-6	1¾	1-7	1½	9½	1¾	8	1½	4	1½	8½	3	8	1-2½	1-1⅜	2060
				4-0	2		1½		1¾		1½		1½				1-4	1-2 3/16	2600
13	B		1-9	3-6	1¾	1-7	1½	9½	1¾	8	1½	4	1½	8½	3	8	1-2½	1-1⅜	2060
				4-0	2		1½		1¾		1½		1½				1-4	1-2 3/16	2600

B.1.19.2

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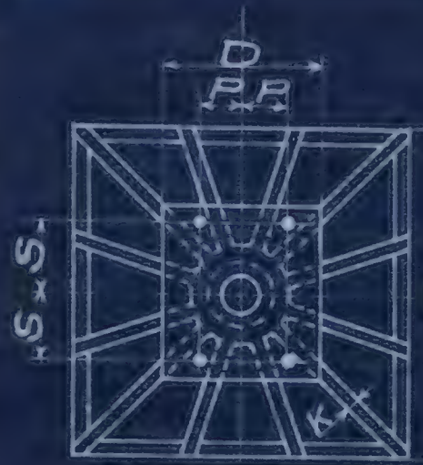
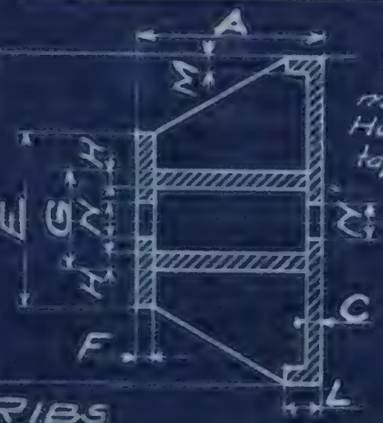
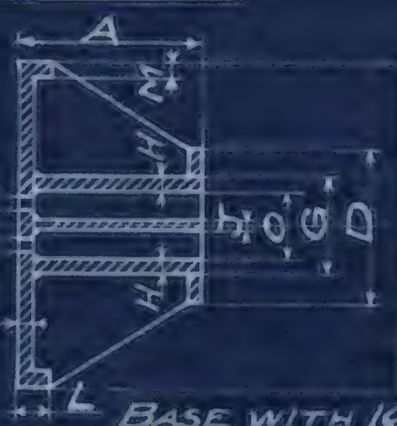
CAST IRON BASES

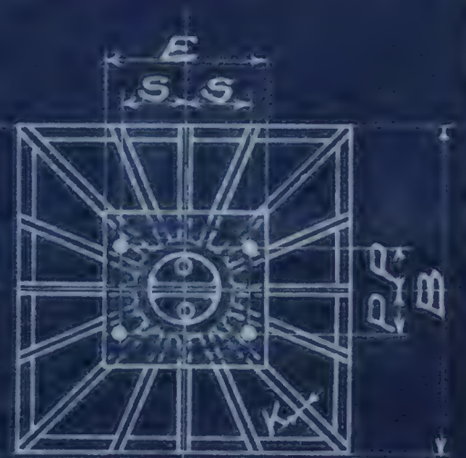
BASES FOR BUILT UP STEEL COLUMNS





Where bases are marked with a *, Hub + Hub Rib are tapered inside and outside; all others outside only.





BASE WITH 12 RIBS

BASE WITH 16 RIBS AND HUB RIB

All bases figured for bearing of 20 tons per □'. Tension 3000* per □"

Hub rib to be used under ⊢⊣ columns only.

Max. Load Tons	Height	Base Plate		Cap Plate			Hub		Hub Rib	Taper of Hub	Ribs		Edge Flange		Core Holes Cap Plate		Core Holes Base Pl.		Holes for Col. Conn.		Est. Weight lbs.	See Note
	A	B	C	D	E	F	G	H	J		№	K	L	M	N	O	N'	O'	P	S		
80	1-0"	2-0	1¼"	1-3"	1-5"	1¼"	10"	1¾"	1¼"	¼"	12	1¼			3"	2"	3"	2	4	6½		
101	1-2	2-3	1¾	1-3	1-5½	1½	10	1¾	1¼	¼	12	1¼			3	2	3	2	4	7		
125	1-4	2-6	1¾	1-4	1-6	1½	10	2	1¼	¼	12	1½			3	2½	3	2½	4	7		
161	1-6	2-9	1¾	1-5	1-7½	1½	11	2	1¼	¼	12	1½			3	2½	3	2½	4½	7½		
180	1-8	3-0	1¾	1-5	1-7½	1½	11	2	1¼	¼	12	1½	3½	1¾	4	2½	4	2½	4½	7½		
212	1-10	3-3	2	1-7	1-9½	1¾	1-0"	2	1¼	¼	12	1½	4	2	4	3	4	3	5	8½		
245	2-0	3-6	2	1-7	1-10	1¾	1-0	2¼	1½	⅜	12	1¾	4	2	7½	7½	2	1½	5	8½		*
320	2-0	4-0	2¼	1-8½	2-0	2	1-3	3¼	2	⅜	12	2½	4½	2¼	8½	8½	2	1½	6	10		*
405	2-3	4-6	2½	1-10⅜	2-3	2	1-4	3¼	2	⅜	12	2¾	5½	2½	9½	9½	2	1½	6½	11		*
500	2-6	5-0	2¼	1-11⅛	2-4	2	1-6	3¼	2	⅜	16	2¾	4½	2¼	11½	11½	2	1½	8¼	1-0"		*
605	2-9	5-6	2½	2-1½	2-6	2¼	1-6	3½	2	½	16	3	5½	2½	11	11	2	1½	8½	1-0½		*
720	3-0	6-0	2¾	2-1	2-6	2½	1-6	3½	2	½	16	3	5½	2¾	11	11	2	1½	8½	1-0½		*

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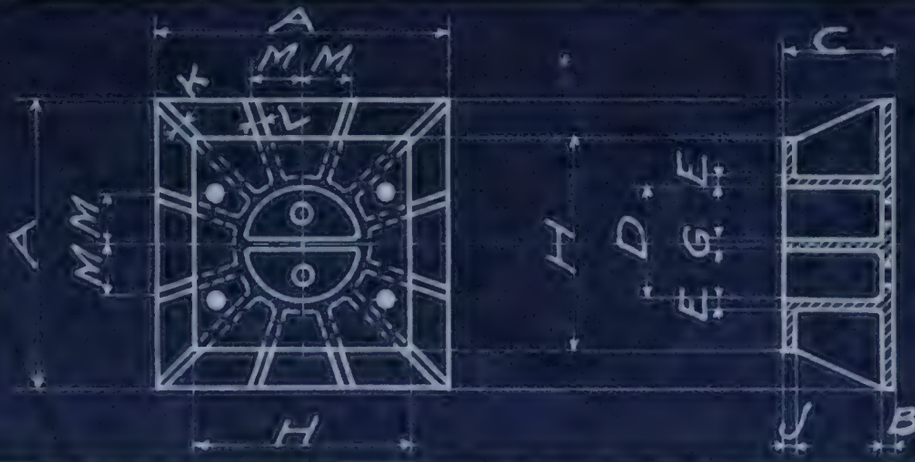

STD. CAST IRON BASES

For Swell & Over-run add to wt. below from 9% for 24-A to 4% for 33-C.

Drill Holes in Cap Plate to suit Column used.

Core two Drain Holes (one each side) ½" diam. in lower end of Hub.

Core Holes 2" diam. in Base Plate.

Thickness of Hub Rib as given under "G" applies only to bases used with Chan. Cols. For ⊏ Cols., Hub Rib "G" is to be increased where necessary.

Mark of Base	Base Plate A	Base Plate B	Height C	Hub Dia. D	Hub Thick E	Hub Rib G	Cap Plate H	Cap Plate J	Ribs Corner K	Ribs Int. L	Ribs Dist. M	Edge Rib O	Edge Rib P	Estimated Weight	Bearing Capacity In Thous lbs per Sq Ft.	Bearing Capacity In lbs. per Sq Inch	Bearing Capacity Total Thous. Lbs.
24 A	2'-0"	1"	0'-9"	9"	1"	1"	1'-6"	1"	1"	1"	4"			450	30	208	120
" B	"	1¼	"	"	"	"	"	"	"	"	"			480	40	275	160
" C	"	1⅜	"	"	"	"	"	"	"	"	"			495	50	350	200
27 A	2-3	1¼	0-9	9	1	1	1-6	1	1	1	4½			550	30	208	150
" B	"	1⅜	"	"	"	"	"	"	"	"	"			570	40	275	200
" C	"	1½	"	"	"	"	"	1⅛	"	"	"			590	50	350	250
30 A	2-6	1⅜	0-9	9	1	1	1-8	1	1	1	5			680	30	208	188
" B	"	1½	"	"	"	"	"	1⅛	"	"	"			710	40	275	250
" C	"	1¾	"	"	1¼	1¼	"	1¼	"	"	"			780	50	350	312
33 A	2-9	1½	1-3	9	1¼	1¼	1-8	1⅛	1	1	5½			1090	30	208	226
" B	"	1¾	"	"	"	"	"	1¼	"	"	"			1160	40	275	302
" C	"	2	"	"	"	"	"	1⅜	"	"	"			1220	50	350	378

No Edge Rib

B1.192A

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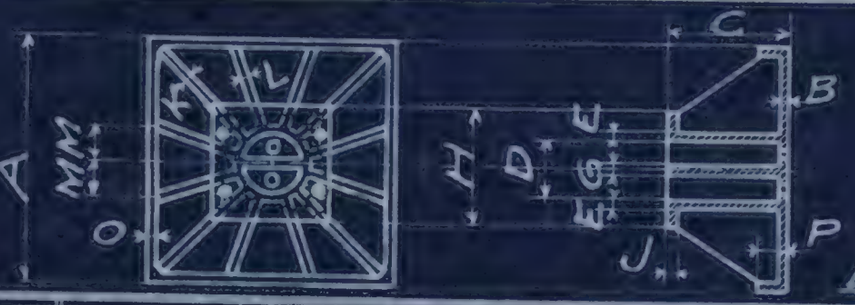

STD. CAST IRON BASES

For Swell + Over-run add to the weight below from 6% for 36A to 7.4% for 57C.

For Note see Sheet B1.192 a+c

Base Pls + Cap Pls are square.

Mark of Base	Base Plate A	Base Plate B	Height C	Hub Dia D	Hub Thick E	Hub Rib G	Cap Plate H	Cap Plate J	Ribs Corner K	Ribs Int. L	Ribs Dist. M	Edge Rib O	Edge Rib P	Estimated Weight	Bearing Capacity In Thous Lbs per Sq Ft.	Bearing Capacity In lbs per Sq.Inch	Bearing Capacity Total Thous Lbs.
36 A	3-0"	1¼	1-3	10"	1¼	1¼	1-9	1¼	1"	1"	6"	1"	2½	1190	30	208	270
" B	"	1⅜	"	"	"	"	"	1⅜	1¼	1¼	"	"	2¾	1330	40	275	360
" C	"	1½	"	"	"	"	"	1½	"	"	"	1¼	3	1390	50	350	450
39 A	3-3	1¼	1-3	10	1¼	1¼	1-9	1¼	1	1	6½	1	2½	1310	30	208	316
" B	"	1½	"	"	"	"	"	1½	1¼	1¼	"	1¼	3	1540	40	275	422
" C	"	1¾	"	"	1½	1½	"	1¾	1½	1½	"	"	3½	1770	50	350	578
42 A	3-6	1⅜	1-3	11	1¼	1¼	2-1	1⅜	1¼	1¼	7	1	2¾	1710	30	208	368
" B	"	1½	"	"	1½	1½	"	1½	"	"	"	1¼	3	1820	40	275	490
" C	"	1¾	"	"	"	"	"	1¾	1½	1½	"	"	3½	2040	50	350	612
45 A	3-9	1½	1-3	11	1¼	1¼	2-1	1½	1¼	1¼	7½	1¼	3	1960	30	208	422
" B	"	1¾	"	"	1½	1½	"	1¾	1½	1½	"	"	3½	2260	40	275	562
" C	"	2	"	"	1¾	1¾	"	2	"	"	"	1½	4	2450	50	350	702
48 A	4-0	1½	1-9	11	1¼	1¼	2-1	1½	1¼	1¼	8	1¼	3	2530	30	208	480
" B	"	1¾	"	"	1½	1½	"	1¾	1½	1½	"	"	3½	2940	40	275	640
" C	"	2	"	"	1¾	1¾	"	2	"	"	"	1½	4	3160	50	350	800
51 A	4-3	1¾	1-9	12	1½	1½	2-3	1¾	1½	1½	8½	1¼	3½	3220	30	208	542
" B	"	2	"	"	1¼	1¾	"	2	1¾	1¾	"	1½	4	3670	40	275	722
" C	"	2	"	"	2	2	"	2	"	"	"	"	"	3720	50	350	902
54 A	4-6	1¾	1-9	12	1½	1½	2-3	1¾	1½	1½	9	1¼	3½	3460	30	208	608
" B	"	2	"	"	1¼	1¾	"	2	1¾	1¾	"	1½	4	3950	40	275	810
" C	"	2¼	"	"	2	2	"	2¼	"	"	"	"	4½	4200	50	350	1012
57 A	4-9	1¾	1-9	13	1½	1½	2-5	1¾	1½	1½	9½	1¼	3½	3770	30	208	676
" B	"	2	"	"	1¾	1¾	"	2	1¾	1¾	"	1½	4	4290	40	275	902
" C	"	2¼	"	"	2	2	"	2¼	"	"	"	"	4½	4610	50	350	1128

B1.192 b

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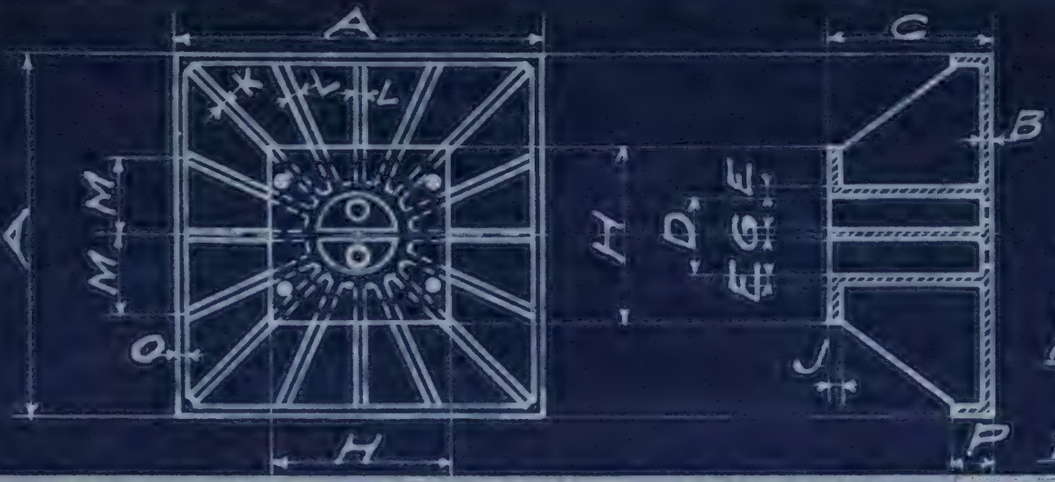


STD. CAST IRON BASES

The Bases are designed for the following Unit Stress.
Fibre Stress from bending (tension & comp) 6000 # per sq. in.
Shear (horizontal or vertical) 3000 # per sq. in.
The weights given below are figured @ 0.260 lbs. per cu. in.
The weights include the fillets @ 0.02 lbs per lin. in. of fillet, but include no percentage for swell or over run.

For Note see Sheet B1.192a

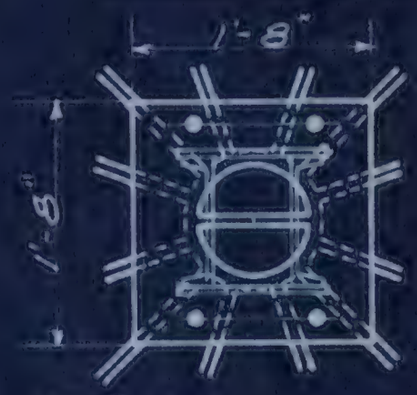
For Swell & Over-run add to the weight below from 2.3% for 60-A to 2% for 72-C.

Mark of Base	Base Plate A	Base Plate B	Height C	Hub Dia D	Hub Thick E	Hub Rib G	Cap Plate H	Cap Plate J	Ribs Corner K	Ribs Int. L	Ribs Dist. M	Edge Rib O	Edge Rib P	Estimated Weight	Bearing Capacity In Thous Lbs per Sq Ft.	Bearing Capacity In lbs per Sq Inch	Bearing Capacity Total Thous Lbs.
60 A	5'-0"	1 3/4	2'-3"	13"	1 3/4"	1 1/2"	2'-5"	1 1/2"	1 1/2"	1 1/2"	1'-0 1/2"	1 1/4"	3 1/2"	5240	30	208	750
" B	"	2	"	"	2	1 3/4	"	1 3/4	1 3/4	"	"	1 1/2	4	5700	40	275	1000
" C	"	2 1/4	"	"	2 1/4	2	"	2	2	1 3/4	"	"	4 1/2	6400	50	350	1250
63 A	5-3	1 3/4	2-3	13	1 3/4	1 1/2	2-5	1 1/2	1 1/2	1 1/2	1-1	1 1/4	3 1/2	5560	30	208	826
" B	"	2	"	"	2	1 3/4	"	1 3/4	1 3/4	"	"	1 1/2	4	6040	40	275	1102
" C	"	2 1/4	"	"	2 1/4	2	"	2	2	1 3/4	"	"	4 1/2	6780	50	350	1378
66 A	5-6	1 3/4	2-3	13	1 3/4	1 1/2	2-5	1 1/2	1 3/4	1 1/2	1-1 3/4	1 1/4	3 1/2	6030	30	208	908
" B	"	2	"	"	2	1 3/4	"	1 3/4	2	1 3/4	"	1 1/2	4	6840	40	275	1210
" C	"	2 1/2	"	"	2 1/4	2	"	2	2 1/4	"	"	"	5	7610	50	350	1512
69 A	5-9	2	2-9	13	2	1 1/2	2-5	1 3/4	1 3/4	1 1/2	1-2 1/4	1 1/2	4	7640	30	208	992
" B	"	2 1/4	"	"	2 1/4	1 3/4	"	2	2	1 3/4	"	"	4 1/2	8610	40	275	1322
" C	"	2 1/2	"	"	2 1/2	2	"	2	2 1/4	"	"	"	5	9180	50	350	1652
72 A	6-0	2	2-9	13	2	1 1/2	2-5	1 3/4	1 3/4	1 1/2	1-3	1 1/2	4	8060	30	208	1080
" B	"	2 1/4	"	"	2 1/4	1 3/4	"	2	2	1 3/4	"	"	4 1/2	9090	40	275	1440
" C	"	2 1/2	"	"	2 1/2	2	"	2	2 1/4	"	"	"	5	9690	50	350	1800

B1.192 c

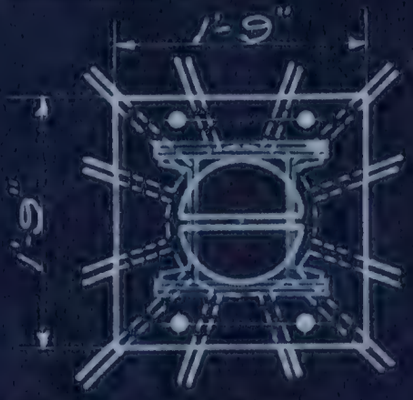
B1.192 d

STD. CAST IRON BASES
TYPES OF COLUMNS



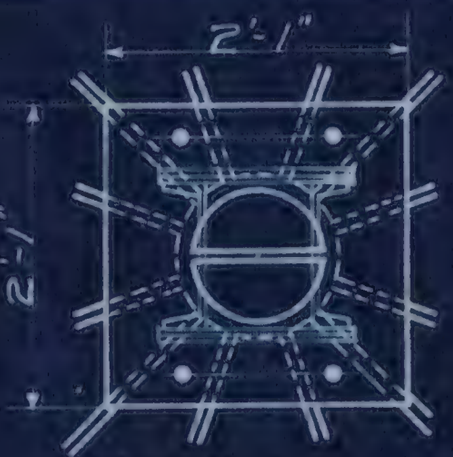
9" HUB

Col.:- 10" Chan.
12" Cov. Pls.



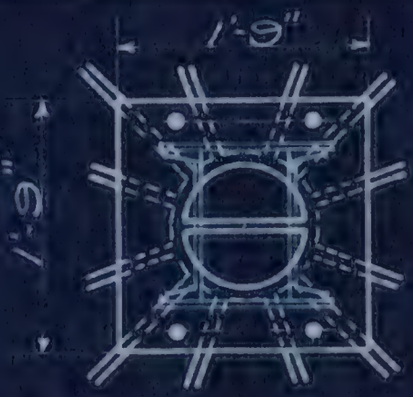
10" HUB

Col.:- 10" Chan.
14" Cov. Pls.



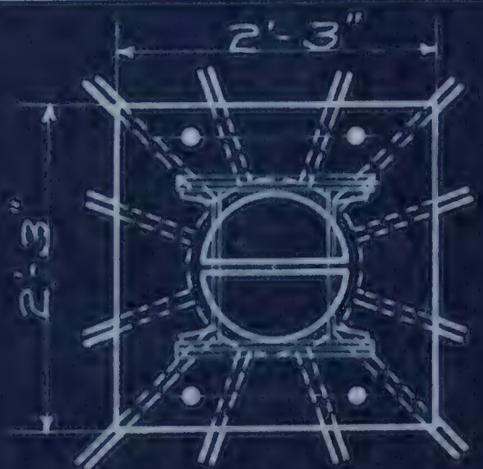
11" HUB

Col.:- 12" Chan.
16" Cov. Pls.



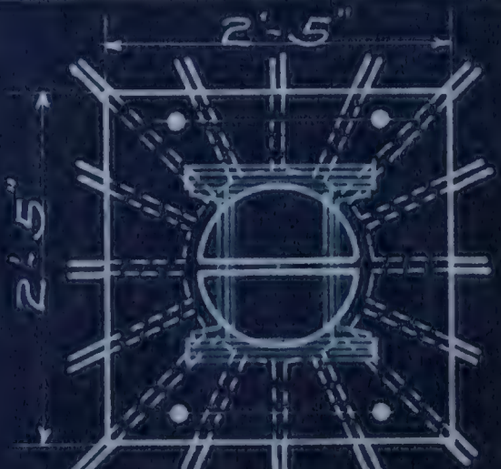
10" HUB

Col.:- 12" Chan.
14" Cov. Pls.



12" HUB

Cols.:- 12" Chan., 16" Cov. Pls.
15" " , 18" " "



13" HUB

Cols.:- 12" Chan., 16" Cov. Pls.
15" " , 18" " "

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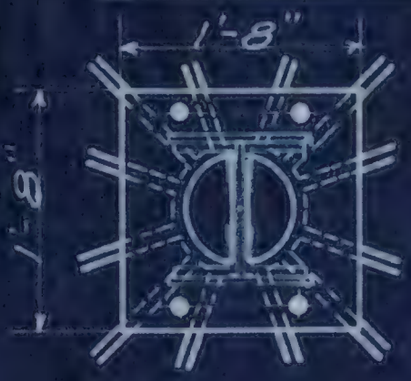
B1.192 e

STD. CAST IRON BASES

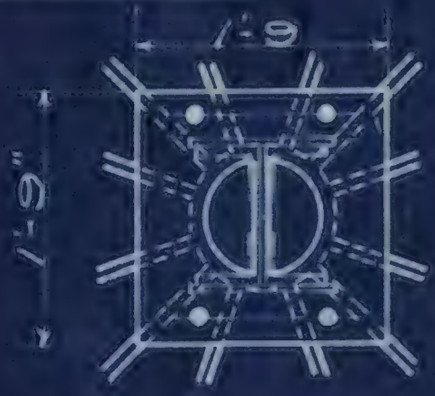
TYPES OF COLUMNS



9" HUB

Col. - Plates + Angles

10" Web, 12" Cov. Pls.

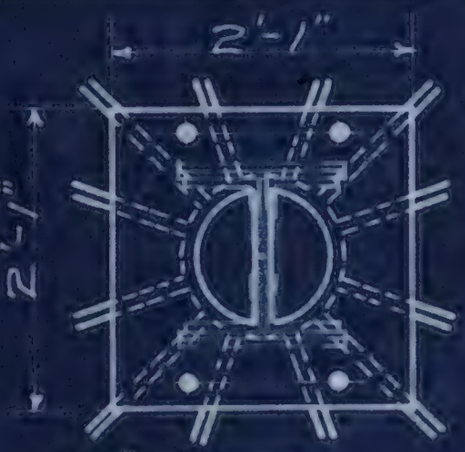


10" HUB

Col. - Plates + Angles

10" Web, 12" Cov. Pls.

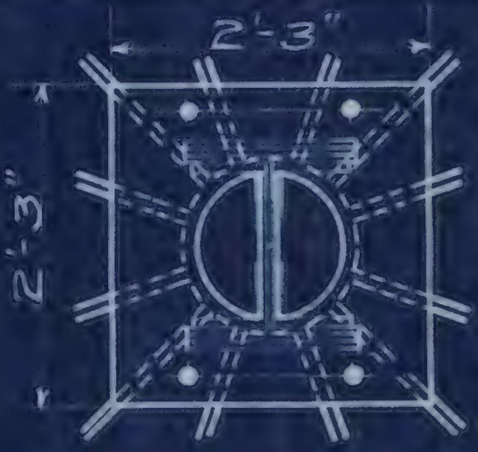
12" " , 14" " "



11" HUB

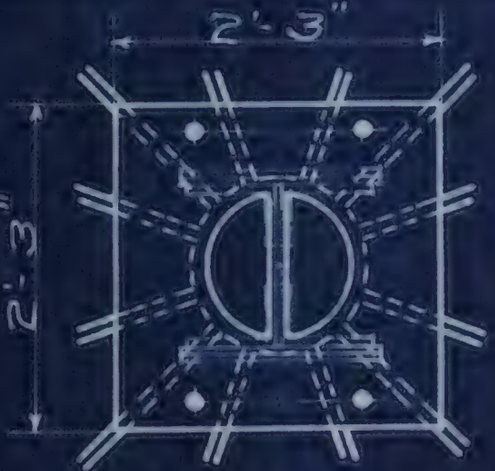
Cols. - 12" Web, 14" Cov. Pls.

14" " , 16" " "



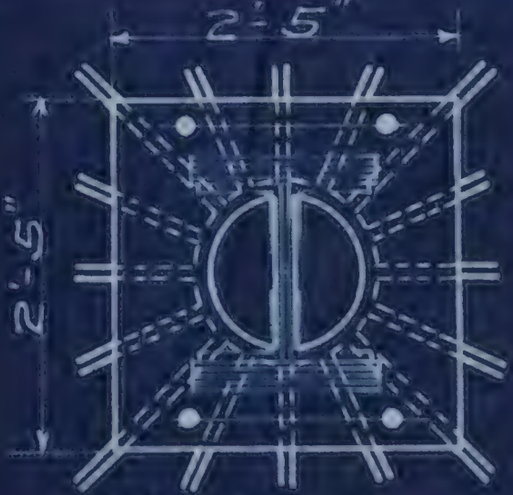
12" HUB

Col. - 12" Web, 14" Cov. Pls.



12" HUB

Col. - 14" Web, 16" Cov. Pls.



13" HUB

Col. - 14" Web, 16" Cov. Pls.

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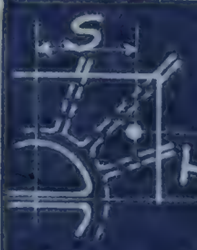
B1.192 f

ORDINATES FOR HOLES IN CAP PLATE OF C.I. BASES



7/8" ϕ Bolts - Hex. or Sq. Nuts

Bases #24 to #33 - Fillet F" = 3/8"

" 36 " 45 - " " = 1/2"

" 48 " 57 - " " = 5/8"

" 60 " 72 - " " = 3/4"

Values of "T" for Varying Values of "S" using Data above.

Pattern Number of Base				Distance "S"													
				7"	7½"	8"	8½"	9"	9½"	10"	10½"	11"	11½"	12"	12½"	13"
24A	24B	24C	Min.	4 3/8	4 1/2											
27A	27B	27C	Max.		4 7/8											
30A	30B	30C	Min.	4 3/8	4 1/2	4 5/8	4 7/8									
33A	33B	33C	Max.		4 7/8	5 3/8	5 7/8									
36A			Min.		4 5/8	4 3/4	5	5 1/8								
39A			Max.			5 1/4	5 3/4	6 1/4								
	36B	36C	Min.			5	5 1/8	5 1/4								
	39B		Max.				5 1/2	6								
		39C	Min.				5 1/4	5 3/8								
			Max.					5 7/8								
42A	42B		Min.			5	5 1/8	5 1/4	5 3/8	5 1/2	5 3/4	5 7/8				
45A			Max.				5 1/2	6	6 1/2	7	7 1/2	8				
48A	45B	42C	Min.				5 1/4	5 3/8	5 1/2	5 3/4	5 7/8	6				
		45C	Max.					5 7/8	6 3/8	6 7/8	7 3/8	7 7/8				
	48B	48C	Min.					5 5/8	5 3/4	5 7/8	6	6 1/4				
			Max.						6 1/8	6 5/8	7 1/8	7 5/8				
51A			Min.					5 5/8	5 3/4	5 7/8	6	6 1/8	6 3/8	6 1/2		
54A			Max.						6 1/8	6 5/8	7 1/8	7 5/8	8 1/8	8 5/8		
	51B	51C	Min.						5 7/8	6	6 1/8	6 1/4	6 1/2	6 5/8		
	54B	54C	Max.							6 1/2	7	7 1/2	8	8 1/2		
57A			Min.					5 5/8	5 3/4	5 7/8	6	6 1/8	6 3/8	6 1/2	6 5/8	6 7/8
			Max.						6 1/8	6 5/8	7 1/8	7 5/8	8 1/8	8 5/8	9 1/8	9 3/8
	57B	57C	Min.						5 7/8	6	6 1/8	6 1/4	6 1/2	6 5/8	6 3/4	7
			Max.							6 1/2	7	7 1/2	8	8 1/2	9	9 1/2
60A			Min.								7	7 1/4	7 1/2	7 3/4	7 7/8	8 1/8
63A			Max.									7 1/2	8	8 1/2	9	9 1/2
66A	60B		Min.									7 1/4	7 1/2	7 3/4	7 7/8	8 1/8
69A	63B		Max.										7 3/4	8 1/4	8 3/4	9 1/4
	66B	60C	Min.										7 5/8	7 7/8	8	8 1/4
	69B	63C	Max.										8 1/8	8 5/8	9 1/8	
		66C	Min.											7 7/8	8 1/8	8 1/4
		69C	Max.											8 1/2	9	
72A			Min.									7 1/4	7 1/2	7 3/4	7 7/8	8 1/8
			Max.									7 3/4	8 1/8	8 3/4	8 3/4	9 1/4
	72B	72C	Min.											7 7/8	8 1/8	8 1/4
			Max.											8 1/2	9	

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O.K. 1-3-12

N.P.F. - 1-20-09.

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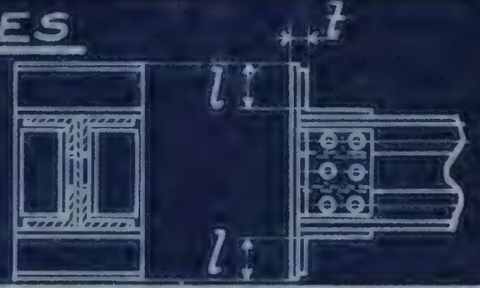
ALLOWABLE VALUE OF "l" IN RELATION TO "P" + "t", OF BASES

$$l = \frac{t}{\sqrt{\frac{3P}{20000}}}$$ in which "t" = Total thickness at any point; "l" = Distance from that point to edge of base in inches; "P" = Pressure per sq. in. on base.



P	Value of t																					
	1/16	1/8	3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	13/16	7/8	15/16	1	1 1/16	1 1/8	1 3/16	1 1/4	1 5/16	1 3/8
25	1	2	3	4 1/16	5 1/16	6 1/16	7 1/8	8 1/8	9 1/8	10 3/16	11 3/16	12 3/16	13 1/4	14 1/4	15 1/4	16 5/16	17 5/16	18 5/16	19 3/8	20 3/8	21 3/8	22 7/16
50	11/16	1 7/16	2 1/8	2 7/8	3 9/16	4 5/16	5	5 3/4	6 7/16	7 3/16	7 15/16	8 5/8	9 3/8	10 1/16	10 13/16	11 1/2	12 1/4	12 15/16	13 11/16	14 3/8	15 1/8	15 7/8
75	9/16	1 1/8	1 3/4	2 5/16	2 15/16	3 1/2	4 1/8	4 11/16	5 1/4	5 7/8	6 7/16	7 1/16	7 5/8	8 1/4	8 13/16	9 3/8	10	10 9/16	11 3/16	11 3/4	12 3/8	12 15/16
100	1/2	1	1 1/2	2	2 1/2	3	3 9/16	4 1/16	4 9/16	5 1/16	5 9/16	6 1/16	6 5/8	7 1/8	7 5/8	8 1/8	8 5/8	9 1/8	9 11/16	10 3/16	10 11/16	11 3/16
125	7/16	7/8	1 5/16	1 13/16	2 1/4	2 11/16	3 3/16	3 5/8	4 1/16	4 9/16	5	5 7/16	5 7/8	6 3/8	6 13/16	7 1/4	7 3/4	8 3/16	8 5/8	9 1/8	9 9/16	10
150	3/8	13/16	1 1/4	1 5/8	2 1/16	2 1/2	2 7/8	3 5/16	3 3/4	4 1/8	4 9/16	5	5 3/8	5 13/16	6 1/4	6 5/8	7 1/16	7 1/2	7 7/8	8 5/16	8 3/4	9 1/8
175	3/8	11/16	1 1/8	1 1/2	1 7/8	2 5/16	2 11/16	3 1/16	3 7/16	3 13/16	4 3/16	4 5/8	5	5 3/8	5 3/4	6 1/8	6 1/2	6 15/16	7 5/16	7 11/16	8 1/16	8 7/16
200	5/16	11/16	1 1/16	1 7/16	1 3/4	2 1/8	2 1/2	2 7/8	3 3/16	3 9/16	3 15/16	4 5/16	4 11/16	5	5 3/8	5 3/4	6 1/8	6 7/16	6 13/16	7 3/16	7 9/16	7 15/16
225	5/16	5/8	1	1 5/16	1 11/16	2	2 3/8	2 11/16	3 1/16	3 3/8	3 11/16	4 1/16	4 3/8	4 3/4	5 1/16	5 7/16	5 3/4	6 1/8	6 7/16	6 3/4	7 1/8	7 7/16
250	5/16	5/8	15/16	1 1/4	1 9/16	1 7/8	2 1/4	2 9/16	2 7/8	3 3/16	3 1/2	3 13/16	4 3/16	4 1/2	4 13/16	5 1/8	5 7/16	5 3/4	6 1/8	6 7/16	6 3/4	7 1/16
275	1/4	9/16	7/8	1 3/16	1 1/2	1 13/16	2 1/8	2 7/16	2 3/4	3 1/16	3 3/8	3 11/16	4	4 1/4	4 9/16	4 7/8	5 3/16	5 1/2	5 13/16	6 1/8	6 7/16	6 3/4
300	1/4	9/16	7/8	1 1/8	1 7/16	1 3/4	2 1/16	2 5/16	2 5/8	2 15/16	3 3/16	3 1/2	3 5/16	4 1/8	4 3/8	4 11/16	5	5 1/4	5 9/16	5 7/8	6 3/16	6 7/16
325	1/4	9/16	13/16	1 1/8	1 3/8	1 11/16	1 15/16	2 1/4	2 1/2	2 13/16	3 1/16	3 3/8	3 5/8	3 15/16	4 3/16	4 1/2	4 13/16	5 1/16	5 3/8	5 5/8	5 15/16	6 3/16
350	1/4	1/2	13/16	1 1/16	1 5/16	1 5/8	1 7/8	2 1/8	2 7/16	2 11/16	3	3 1/4	3 1/2	3 13/16	4 1/16	4 5/16	4 5/8	4 7/8	5 1/8	5 7/16	5 11/16	6
375	1/4	1/2	3/4	1	1 5/16	1 9/16	1 13/16	2 1/16	2 5/16	2 5/8	2 7/8	3 1/8	3 3/8	3 11/16	3 15/16	4 3/16	4 7/16	4 3/4	5	5 1/4	5 1/2	5 3/4
400	1/4	1/2	3/4	1	1 1/4	1 1/2	1 3/4	2	2 1/4	2 1/2	2 3/4	3	3 5/16	3 9/16	3 13/16	4 1/16	4 5/16	4 9/16	4 13/16	5 1/16	5 5/16	5 9/16
425	1/4	1/2	3/4	1	1 1/4	1 1/2	1 3/4	2	2 1/4	2 1/2	2 3/4	3	3 3/16	3 7/16	3 11/16	3 15/16	4 3/16	4 7/16	4 11/16	4 15/16	5 3/16	5 7/16
450	3/16	7/16	11/16	15/16	1 3/16	1 7/16	1 5/8	1 7/8	2 1/8	2 3/8	2 5/8	2 7/8	3 1/8	3 5/16	3 9/16	3 13/16	4 1/16	4 5/16	4 9/16	4 3/4	5	5 1/4
475	3/16	7/16	11/16	15/16	1 1/8	1 3/8	1 5/8	1 13/16	2 1/16	2 5/16	2 9/16	2 3/4	3	3 1/4	3 1/2	3 11/16	3 15/16	4 3/16	4 7/16	4 11/16	4 7/8	5 1/8
500	3/16	7/16	5/8	7/8	1 1/8	1 5/16	1 9/16	1 3/16	2	2 1/4	2 1/2	2 11/16	2 15/16	3 3/16	3 3/8	3 5/8	3 7/8	4 1/16	4 5/16	4 9/16	4 3/4	5

B1.193 a

LIMITING VALUES AND SHEARS FOR "I"s

Depth of Beam	Wt. per Ft.	Static Moment of ½ of beam about C.L.	Limiting Values using 16000# "a" F.S. To develope 10000# "a" hor. shear at N. Axis. Total Vertical End S.	Vert. Shear per Sq. In.	Corr. lgth of Bm in Ft.	Standard Brg. Pl.	Bearing on Brick Wall 150# per □" Total Shear	Cor. lgth of Bm in Ft.	200# per □" Total Shear	Cor. lgth of Bm in Ft.	Safe Stress for crushing Webs without Stiffening per Sq. In.	per lin. In. of I
24	115	145.4	153	8.5	8.6	16×16"	38.4	34.3	51.2	25.7	12.9	9.7
	100	119.7	150	8.3	7.1	"	"	27.6	"	20.7	12.8	9.6
	95	115.2	139	8.4	7.4	"	"	26.7	"	20.0	12.3	8.5
	90	110.8	128	8.4	7.8	"	"	25.9	"	19.4	11.8	7.4
	85	106.5	116	8.5	8.3	"	"	25.1	"	18.8	11.1	6.3
	80	101.4	103	8.6	9.0	"	"	24.2	"	18.1	10.2	5.1
20	100	100.1	146	8.3	6.0	"	"	23.0	"	17.2	14.3	12.7
	95	96.4	135	8.3	6.4	"	"	22.3	"	16.7	14.0	11.4
	90	92.8	124	8.4	6.7	"	"	21.6	"	16.2	13.7	10.1
	85	89.1	112	8.5	7.2	"	"	21.0	"	15.7	13.3	8.8
	80	85.9	102	8.5	7.6	"	"	20.4	"	15.3	12.8	7.7
	75	76.0	108	8.4	6.2	"	"	17.6	"	13.2	13.0	8.4
	70	72.3	97	8.4	6.7	"	"	16.9	"	12.7	12.4	7.1
	65	68.6	85	8.5	7.3	"	"	16.2	"	12.2	11.6	5.8
18	70	62.2	106	8.2	5.1	"	"	14.2	"	10.7	13.9	10.0
	65	58.9	95	8.3	5.5	"	"	13.6	"	10.2	13.4	8.6
	60	55.6	84	8.4	5.9	"	"	13.0	"	9.7	12.8	7.1
	55	51.7	71	8.5	6.7	"	"	12.3	"	9.2	11.7	5.4
15	100	74.0	144	8.1	4.4	16×12"	28.8	22.2	38.4	16.7	15.5	18.4
	95	71.2	133	8.2	4.7	"	"	21.5	"	16.2	15.5	16.8
	90	68.4	122	8.2	4.9	"	"	20.9	"	15.7	15.4	15.2
	85	65.7	111	8.3	5.3	"	"	20.2	"	15.2	15.2	13.5
	80	63.5	101	8.4	5.6	"	"	19.6	"	14.7	15.1	12.2
	75	56.0	109	8.2	4.5	"	"	17.1	"	12.8	15.1	13.3
	70	53.3	98	8.3	4.8	"	"	16.4	"	12.3	14.9	11.7
	65	50.5	86	8.4	5.2	"	"	15.7	"	11.8	14.6	10.0
	60	47.8	75	8.5	5.8	"	"	15.0	"	11.3	14.1	8.3
	55	41.2	81	8.3	4.5	"	"	12.6	"	9.5	14.3	9.4
	50	38.4	70	8.4	4.9	"	"	11.9	"	9.0	13.7	7.6
	45	35.6	59	8.5	5.5	"	"	11.2	"	8.4	12.8	5.9
	42	34.2	53	8.6	5.9	"	"	10.9	"	8.2	12.2	5.0
12	55	32.7	81	8.2	3.5	12"×12"	21.6	13.2	28.8	9.9	15.3	12.6
	50	30.5	69	8.3	3.9	"	"	12.5	"	9.4	15.1	10.5
	45	28.3	58	8.4	4.4	"	"	11.8	"	8.8	14.7	8.5
	40	26.2	47	8.5	5.1	"	"	11.1	"	8.3	14.0	6.5
	35	22.3	45	8.5	4.6	"	"	9.4	"	7.1	13.7	6.0
	31.5	20.7	36	8.7	5.3	"	"	8.9	"	6.7	12.7	4.4
10	40	19.6	61	8.1	2.8	12"×8"	14.4	11.8	19.2	8.8	15.4	11.5
	35	17.7	50	8.3	3.1	"	"	10.9	"	8.1	15.1	9.1
	30	15.8	39	8.5	3.7	"	"	9.9	"	7.4	14.5	6.6
	25	14.0	27	8.7	4.8	"	"	9.0	"	6.8	13.1	4.1
9	35	15.3	53	8.1	2.5	"	"	9.2	"	6.9	15.5	11.3
	30	13.6	42	8.3	2.8	"	"	8.4	"	6.3	15.2	8.7
	25	12.0	31	8.5	3.5	"	"	7.6	"	5.7	14.5	5.9
	21	10.8	23	8.7	4.4	"	"	7.0	"	5.2	13.3	3.9
8	25.5	10.3	36	8.3	2.5	8"×8"	9.6	9.5	12.8	7.1	15.3	8.3
	23	9.6	30	8.4	2.8	"	"	9.0	"	6.7	15.0	6.7
	20.5	8.8	24	8.6	3.3	"	"	8.4	"	6.3	14.5	5.2
	18	8.1	19	8.7	4.0	"	"	7.9	"	5.9	13.6	3.7

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LIMITING VALUES AND SHEARS FOR "I's"

Depth of Beam	Wt. per Ft.	Static Moment of ½ of beam about C.L. "I"	Limiting Values using 16000# □" F.S. To develope 10000# □" hor. shear at N.Axis: Total Vert. End Shear	Vert. Shear per Sq. In.	Corresp length of Bm in Ft.	Standard Brg. Pl.	Bearing on Brick Wall 150# per □" Total Shear	Corresp length of Bm in Ft.	Bearing on Brick Wall 200# per □" Total Shear	Corresp length of Bm in Ft.	Safe Stress for Crushing Web without Stiffening: per Sq. In.	per lin in. of I
7	20	7.2	27	8.3	2.4	8"×8"	9.6	6.7	12.8	5.0	15.3	7.0
	17.5	6.6	21	8.5	2.8	"	"	6.2	"	4.7	14.8	5.2
	15	5.9	15	8.7	3.6	"	"	5.7	"	4.3	13.9	3.5
6	17.25	5.3	24	8.3	2.0	6"×6"	5.4	8.6	7.2	6.5	15.5	7.4
	14.75	4.7	18	8.5	2.4	"	"	7.9	"	5.9	15.2	5.3
	12.25	4.2	12	8.7	3.2	"	"	7.2	"	5.4	14.2	3.3
5	14.75	3.7	21.0	8.2	1.6	"	"	6.0	"	4.5	15.7	7.9
	12.25	3.2	15.0	8.4	1.9	"	"	5.4	"	4.0	15.5	5.5
	9.75	2.8	9.1	8.7	2.8	"	"	4.8	"	3.6	14.5	3.1
4	10.5	2.2	14.0	8.2	1.4	"	"	3.5	"	2.6	15.8	6.5
	9.5	2.0	11.0	8.3	1.6	"	"	3.3	"	2.5	15.7	5.3
	8.5	1.9	9.0	8.5	1.9	"	"	3.2	"	2.4	15.4	4.1
	7.5	1.7	6.6	8.7	2.4	"	"	3.0	"	2.2	14.9	2.8
3	7.5	1.2	8.9	8.3	1.2	"	"	1.9	"	1.4	15.8	5.7
	6.5	1.1	6.7	8.5	1.5	"	"	1.8	"	1.3	15.7	4.1
	5.5	1.0	4.4	8.7	2.0	"	"	1.6	"	1.2	15.4	2.6

NOTES- FOR Is + Cs

Loads and Stresses given in thousands of lbs.
Carnegie Sections. Fibre Stress = 16000# per sq. in.

Static Moment of ½ of beam about Neutral Axis = product of area above neutral axis by distance from center of gravity of that area to the neutral axis.

Horizontal Shear per sq. in. at neutral axis = total vertical shear times the static moment divided by the moment of inertia of entire beam times the thickness of web.

Vertical Shear per sq. in., col. 5, is the max. allowable vertical shear per sq. in. on web without reinforcing the web. It is figured on the full depth of beam by the thickness of web.

Limiting values of beams bearing on brick walls. Take for an example an 8" I 18#. Bearing Pl., 8"×8", × 150# = 9600#. ⅛ × 9600 × 2 × 7.9 = 18900 ft lbs. which is the max. allowable moment for the beam.

Safe Stress for crushing on web of "I" or "⊔" without side stiffening = $16000 \div (1 + d^2/3000t^2)$ in which "d" = tangent dist. in inches, "t" = thickness of web in inches.

Take for example a 12" I 40# bearing 7" on another beam. From the table, the max. allowable stress per horizontal sq. in. of web = 14000#. The max. allowable stress per horizontal lineal inch of web = 14000# × .46" (thickness of web) = 6500# (see table). ∴ 6500 × 7 = 45500# which is the max. allowable reaction without stiffening the web.

The max. allowable vertical shear for the same beam without reinforcing the web = 47600# ÷ (12 × .46" × 5.5") = 8500# per sq. inch of web as given in table.

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LIMITING VALUES AND SHEARS FOR "S"

Loads and Stresses given in thousands of lbs.
Carnegie Sections. - Fibre Stress = 16000# per sq. in.
For General Notes see Sheet B5.012 b.

Depth of Chan.	Wt. per Ft.	Static Moment of ½ about C.L.	Limiting Values using 16000# "U" F.S. To develope 10000# horizontal shear at Neutral Axis: Total Vertical End Shear	Vert Shear per Sq. In.	Corresp length of Bm in Ft.	Standard Brg. Pl.	Bearing on Brick Wall 150# per □" Total Shear	Corresp length of Bm in Ft.	Bearing on Brick Wall 200# per □" Total Shear	Corresp length of Bm in Ft.	Safe Stress for crushing web without Stiffening 16000 − 70 d/t	
											per Sq. In.	per lin. in. of □
18	45	40.9	65	8.3	5.5							
15	55	37.0	95	7.7	3.2	16"-12"	28.8	10.6	38.4	8.0	14.9	12.2
	50	34.2	85	7.8	3.4	"	"	9.9	"	7.5	14.6	10.5
	45	31.5	74	7.9	3.6	"	"	9.3	"	6.9	14.1	8.8
	40	28.7	63	8.1	3.9	"	"	8.6	"	6.4	13.5	7.1
	35	26.0	52	8.2	4.3	"	"	7.9	"	5.9	12.5	5.3
	33	25.2	50	8.3	4.5	"	"	7.7	"	5.8	12.1	4.9
12	40	21.3	70	7.7	2.5	12"-12"	21.6	8.1	28.8	6.1	15.1	11.5
	35	19.1	60	7.8	2.7	"	"	7.4	"	5.5	14.8	9.4
	30	16.9	49	8.0	2.9	"	"	6.6	"	5.0	14.2	7.3
	25	14.7	38	8.2	3.4	"	"	5.9	"	4.4	13.1	5.1
	20.5	12.7	28	8.4	4.0	"	"	5.3	"	4.0	11.2	3.1
10	35	15.2	62	7.6	2.0	12"-8"	14.4	8.6	19.2	6.4	15.5	12.7
	30	13.4	52	7.7	2.1	"	"	7.6	"	5.7	15.2	10.3
	25	11.5	42	7.9	2.3	"	"	6.7	"	5.1	14.8	7.8
	20	9.7	31	8.1	2.7	"	"	5.8	"	4.4	13.8	5.3
	15	7.9	20	8.4	3.5	"	"	4.9	"	3.7	11.5	2.8
9	25	10.1	43	7.8	2.0	"	"	5.8	"	4.4	15.3	9.4
	20	8.5	33	8.0	2.2	"	"	5.0	"	3.8	14.7	6.7
	15	6.8	22	8.3	2.8	"	"	4.2	"	3.1	13.2	3.8
	13.25	6.2	18	8.5	3.2	"	"	3.9	"	2.9	12.0	2.8
8	21.25	7.7	36	7.8	1.8	8"-8"	9.6	6.6	12.8	5.0	15.4	8.9
	18.75	6.9	31	7.9	1.9	"	"	6.1	"	4.6	15.1	7.4
	16.25	6.2	26	8.0	2.1	"	"	5.5	"	4.2	14.7	5.9
	13.75	5.5	20	8.2	2.4	"	"	5.0	"	3.8	14.0	4.3
	11.25	4.8	15	8.4	2.9	"	"	4.5	"	3.4	12.5	2.7
7	19.75	6.2	34	7.7	1.5	"	"	5.3	"	4.0	15.6	9.9
	17.25	5.5	29	7.8	1.6	"	"	4.8	"	3.6	15.4	8.1
	14.75	4.9	24	8.0	1.8	"	"	4.3	"	3.2	15.1	6.4
	12.25	4.2	18	8.2	2.0	"	"	3.8	"	2.9	14.5	4.6
	9.75	3.6	12	8.4	2.6	"	"	3.3	"	2.5	13.0	2.7
6	15.5	4.2	26	7.7	1.4	6"-6"	5.4	6.4	7.2	4.8	15.6	8.8
	13	3.6	21	7.9	1.5	"	"	5.7	"	4.3	15.4	6.8
	10.5	3.1	15	8.1	1.7	"	"	5.0	"	3.7	14.9	4.7
	8	2.6	10	8.4	2.3	"	"	4.3	"	3.2	13.6	2.7
5	11.5	2.6	19	7.9	1.1	"	"	4.1	"	3.1	15.7	7.5
	9	2.2	13	8.1	1.4	"	"	3.5	"	2.6	15.4	5.1
	6.5	1.7	8	8.5	2.0	"	"	2.9	"	2.2	14.3	2.7
4	7.25	1.4	11.0	8.1	1.2	"	"	2.3	"	1.7	15.6	5.1
	6.25	1.3	8.4	8.3	1.3	"	"	2.1	"	1.6	15.4	3.9
	5.25	1.1	6.1	8.5	1.7	"	"	1.9	"	1.4	14.8	2.7
3	6	.9	8.7	8.0	.9	"	"	1.4	"	1.0	15.8	5.7
	5	.8	6.2	7.9	1.0	"	"	1.2	"	.9	15.7	4.1
	4	.7	4.2	8.2	1.4	"	"	1.1	"	.8	15.4	2.6

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A.B.C.'s Standard.
As Approved: 4-7-'08

BEAMS

STD. CONNECTION ANGLES

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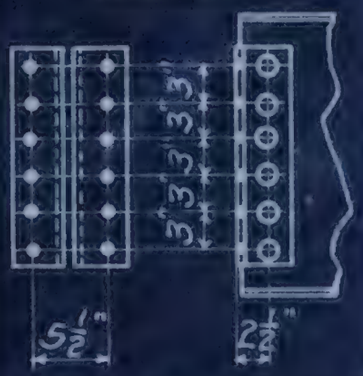
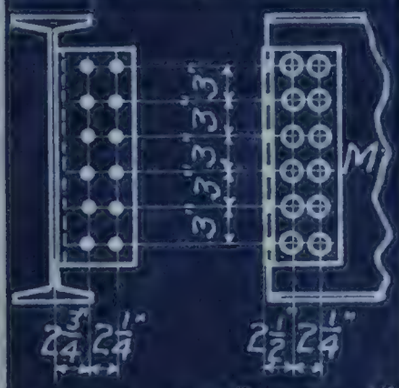
C. & E.R. Co's Standard.
As Approved;- 10-7-10.

24"

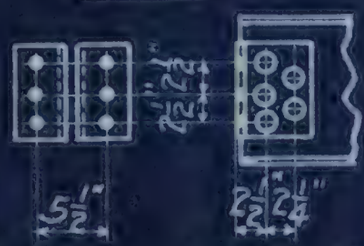


2-Ls 4" x 4" x 7/16" - 1' 5½"
Wt. 36# - Cap. 42000#

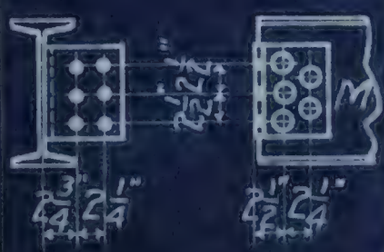


1-L 6" x 6" x 7/16" - 1' 5½"
Wt. 32# - Cap. 27000#

12"

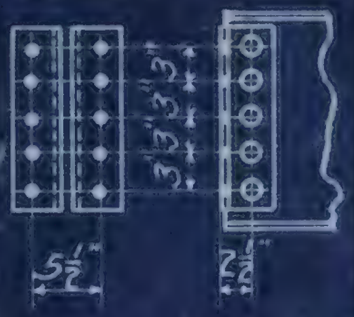


2-Ls 6" x 4" x 7/16" - 7½"
Wt. 20# - Cap. 21000#

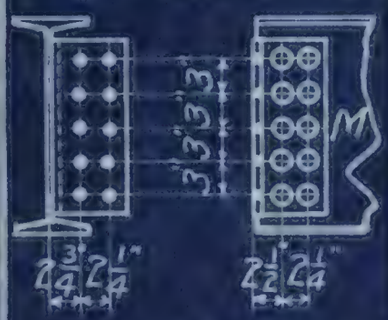


1-L 6" x 6" x 7/16" - 7½"
Wt. 13# - Cap. 8400#

20" + 18"



2-Ls 4" x 4" x 7/16" - 1' 2½"
Wt. 30# - Cap. 35000#



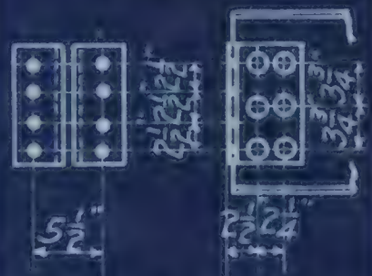
1-L 6" x 6" x 7/16" - 1' 2½"
Wt. 26# - Cap. 20700#

10", 9", 8", + 7"

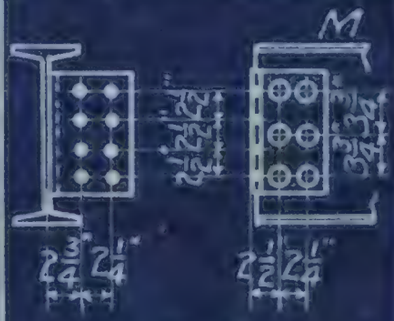
2-Ls 6" x 4" x 7/16" - 5"
Wt. 14# - Cap. 14000#

1-L 6" x 6" x 7/16" - 5"
Wt. 9# - Cap. 4600#

15"



2-Ls 6" x 4" x 7/16" - 10"
Wt. 27# Cap. 28000#



1-L 6" x 6" x 7/16" - 10"
Wt. 17# - Cap. 13000#

6", 5", 4", + 3"

2-Ls 6" x 4" x 7/16" —

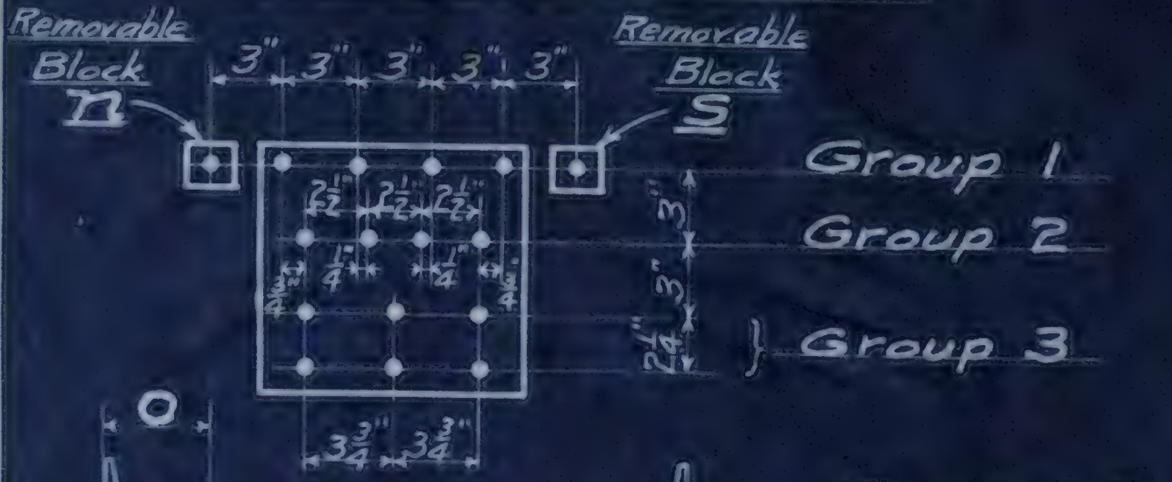
2½" lg. Wt. 7# For 6" + 5"
2" " " 6" + 4" + 3"
Cap. 7000# " 6"
" 6500# " others

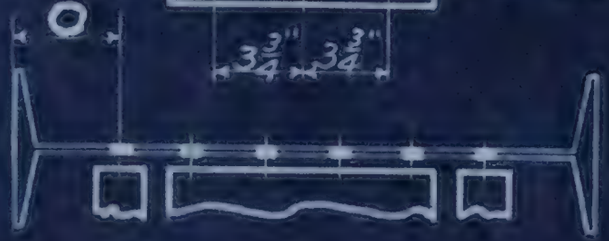
1-L 6" x 6" x 7/16" —
2½" lg. Wt. 5# For 6" + 5"
2 " " 4" " 4" + 3"
Cap. 1700#

Shop Rivets - ¾" diam. → 10000# 20000#
Figured for Shear Bearing
Field Rivets - ¾" diam. → 8000# 16000#

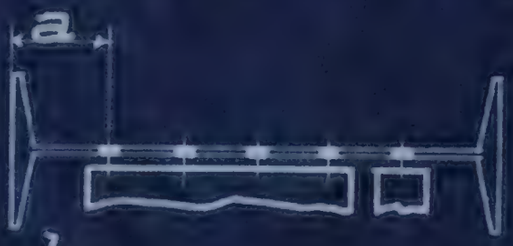
J.A.A. 5-24-10

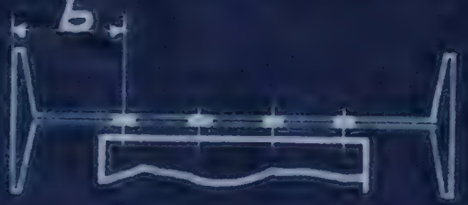
MULTIPLE PUNCH

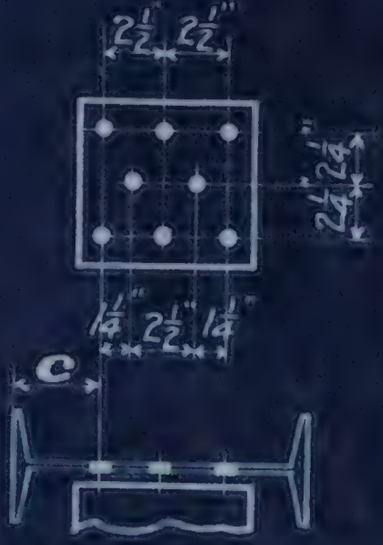




Group 4

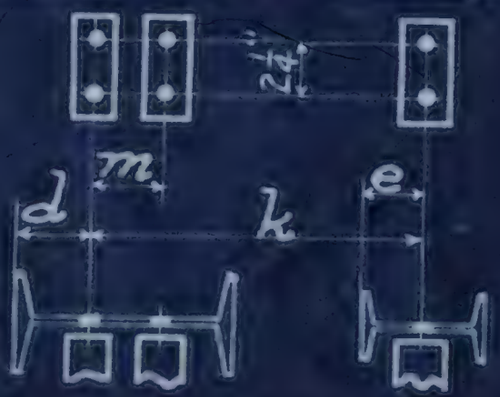






ADJUSTABLE BLOCKS

Group 5 Group 6



Adjustable only on the Ambridge Punch

For Pencoyd Punch

$m = 2\frac{1}{2}"$

$k = 10"$

For Ambridge Punch

$m = 2"$ to $9\frac{1}{4}"$

$k = 4"$ to $11\frac{1}{4}"$

Holes in any block can be punched at one stroke and any or all holes in any block can be omitted.
Holes in Groups 1, 2 & 3 or any two of them may be combined. Holes in these 3 groups should not be used together with holes from any other group in the same beam.
Holes in Group 4 should not be used together with holes from any other group in the same beam.
Holes in Groups 5 & 6 may be combined.

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A.A.Co's Standard
As Approved:- 6-10-07.

MULTIPLE PUNCH

For Sketches see Sheet B5.014 a

CARNEGIE SECTIONS			GROUP														PENCOYD SECTIONS		
			1						2+3		4		5		6				
			a																
Kind	Size Inches	Weight Lbs	o		Omit n		Omit n.s		b		c		d		e		Weight Lbs.	Size Inches	Kind
			Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.			
	24	115	2 3/4	6 1/4	2 3/4	9 1/4	2 3/4	12 1/4	3 1/2	13	2 3/4	16 1/4						24	
		80-100	2 1/2	6 1/2	2 1/2	9 1/2	2 1/2	12 1/2	3 1/4	13 1/4	2 1/2	16 1/2							
			2 5/8	5 3/8	2 5/8	5 1/2	2 5/8	8 3/8	3 3/8	9 1/8	2 5/8	12 3/8					90-100		
	20	80-100	2 1/2	5 1/2	2 1/2	5 1/2	2 1/2	8 1/2	3 1/4	9 1/4	2 1/2	12 1/2					75-85	20	
		65-75	2 1/4	5 3/4	2 1/4	5 3/4	2 1/4	8 3/4	3	9 1/2	2 1/4	12 3/4					65-70		
	18		2 3/8	3 3/8	2 3/8	3 5/8	2 3/8	6 5/8	3 1/8	7 3/8	2 3/8	10 5/8					65-70	18	
		All	2 1/4	3 3/4	2 1/4	3 3/4	2 1/4	6 3/4	3	7 1/2	2 1/4	10 3/4					55-60		
		80-100					2 3/8	3 1/4	3 1/2	4	2 3/4	7 1/4					80-100		
	15	60-75					2 3/8	3 5/8	3 1/8	4 3/8	2 3/8	7 5/8					60-75	15	
							2 1/4	3 3/4	3	4 1/2	2 1/4	7 3/4					50-55		
		42-55					2 1/8	3 7/8	2 7/8	4 5/8	2 1/8	7 7/8					42-45		
											2 3/8	4 5/8	2 3/8	7 3/8			55-65		
	12										2 1/4	4 1/4	2 1/4	7 1/4			50	12	
		40-55									2 1/4	4 3/8	2 1/4	7 1/4			40-45		
		31½-35									2	5	2	7 1/2			31½-35		
H	10										2 1/8	2 7/8	2 1/8	5 3/8			35-40	10	I
		All									1 7/8	3 1/8	1 7/8	5 1/8			25-30		
	9												2 1/8	4 3/8			30-35	9	
		All									1 7/8	2 1/8	1 7/8	4 1/8			21-25		
	8	All											1 3/4	3 3/4	1 3/4	6 1/4	All	8	
	7	All											1 3/4	2 3/4	1 3/4	5 1/4	All	7	
	6	All											1 5/8	1 7/8	1 5/8	4 3/8	All	6	
	5	All													1 5/8	3 3/8	All	5	
	4	All													1 1/2	2 1/2	All	4	
	3	All													1 1/2	1 1/2	All	3	
	15						2 3/8	3 5/8	3 1/8	4 1/8	2 3/8	7 3/8					50-55	15	
		All					2 1/8	3 7/8	2 7/8	4 5/8	2 1/8	7 7/8					33-45		
	12										2 1/4	4 3/4	2 1/4	7 1/4			35-40	12	
		All									1 7/8	5 1/8	1 7/8	7 5/8			20½-30		
	10										2	3	2	5 1/2			25-35	10	
		All									1 7/8	3 1/8	1 7/8	5 5/8			15-20		
	9										1 7/8	7 1/8	1 7/8	4 3/8			20-25	9	
		All									1 3/4	2 1/4	1 3/4	4 1/4			13 1/4-15		
	8												1 3/8	3 5/8	1 3/8	6 1/8	16 1/4-21 1/4	8	
		All											1 1/2	3 3/4	1 1/2	6 1/4	11 1/4-13 3/4		
	7	All											1 1/2	2 1/4	1 1/2	5 1/4	All	7	
	6	All											1 3/8	1 7/8	1 3/8	4 3/8	All	6	
	5	All													1 3/8	3 3/8	All	5	
	4	All													1 3/8	2 3/8	All	4	
	3	All													1 1/2	1 1/2	All	3	

"I" BEAMS

"I" BEAMS

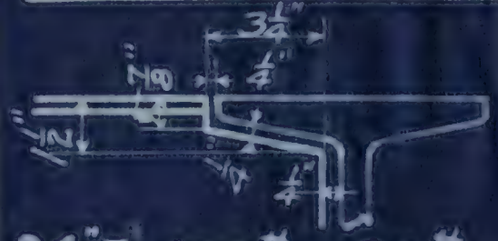
"J" BEAMS

"J" BEAMS

COMPILED BY THE CARNEGIE STEEL CO. AS A STANDARD. 6-1-11

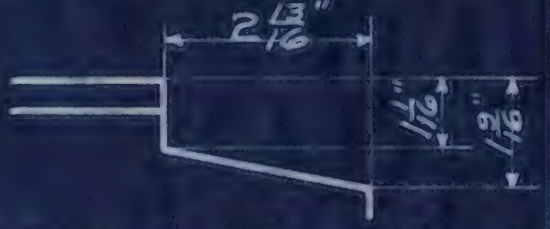
B5.015 a

COPINGS FOR CARNEGIE SECTIONS



24" Is 100# - 80#
20" Is 100# - 80# incl.

20" Is 75# - 65#
18" Is 70# - 55#



15" Is 100# - 80# incl.

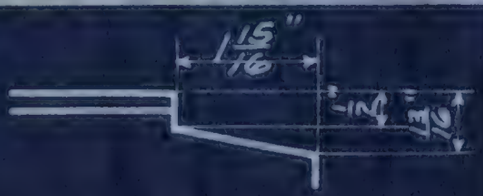
15" Is 75# - 60# incl.

15" Is 55# - 42#
12" Is 55# - 31½#
12" Is all weights

15" Is all weights

10" I + 9" I
10" I + 9" I

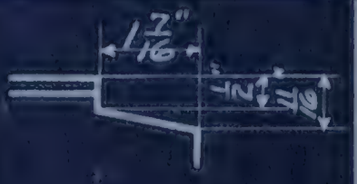
8" I
8" I



7" I
7" I

6" I
6" I

5" I
5" I



4" I
4" I

3" I
3" I

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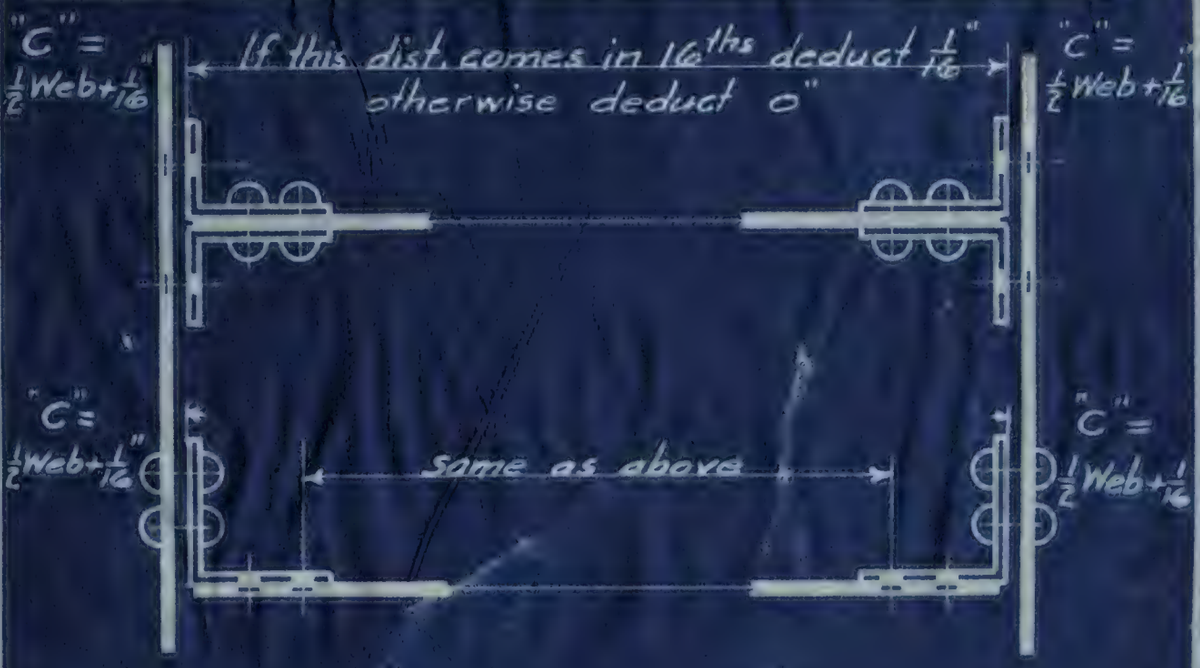
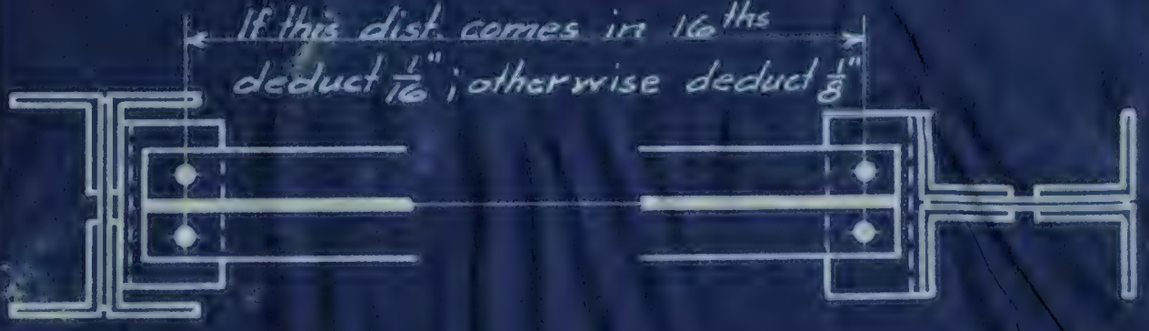
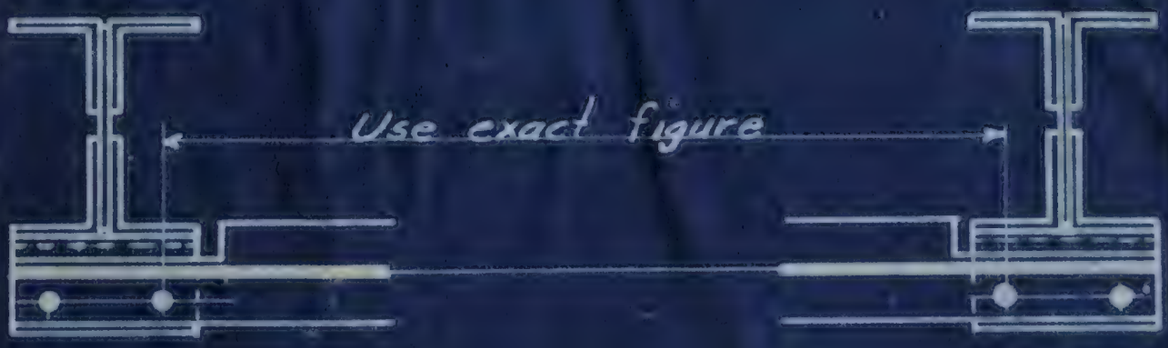
JAA 6-8-10

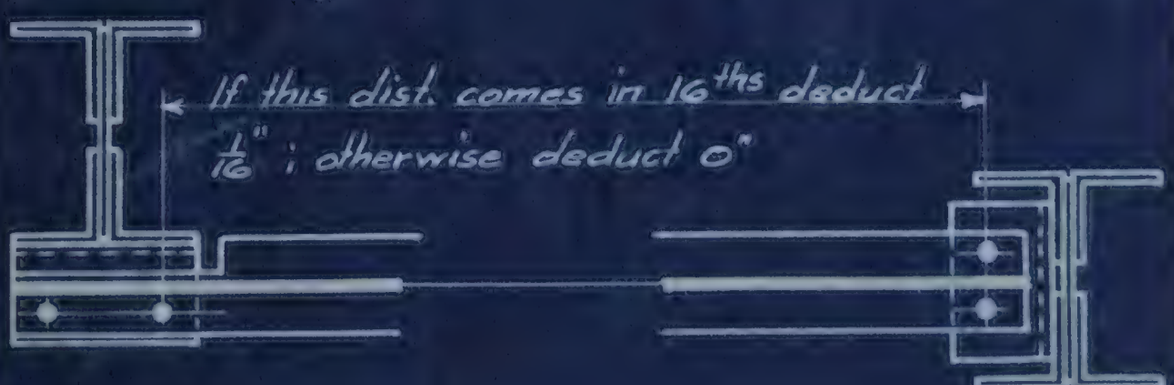
B5.016 a

BEAM FRAMING CLEARANCES









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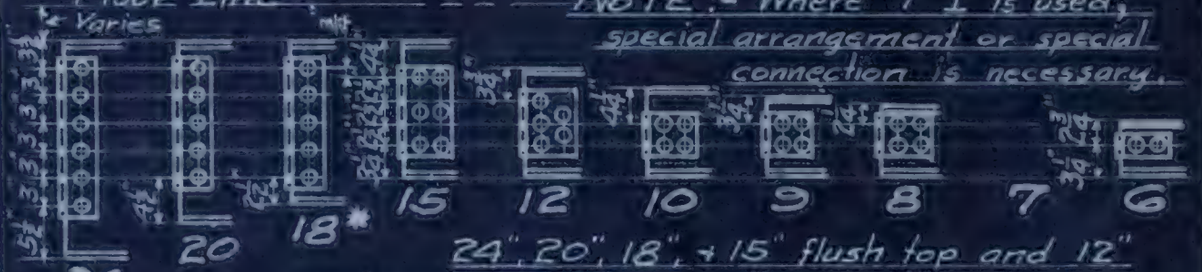
As Approved:- 9-25-07.

7-14-20

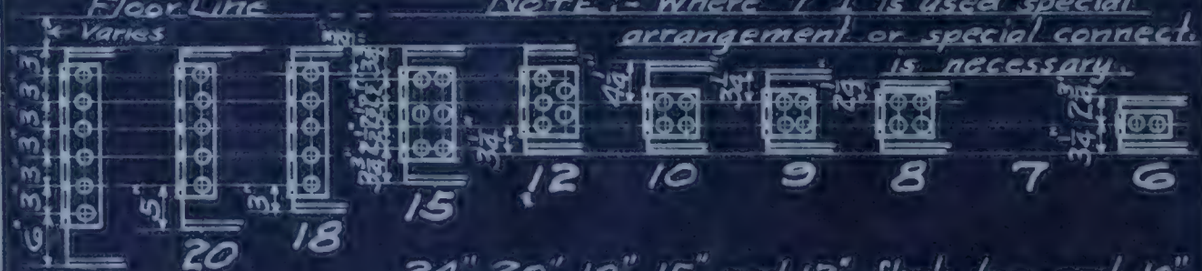
B5.017 a

CONNS. TO SUIT MULTIPLE PUNCH FOR DIFFERENT TYPES OF FLOOR.



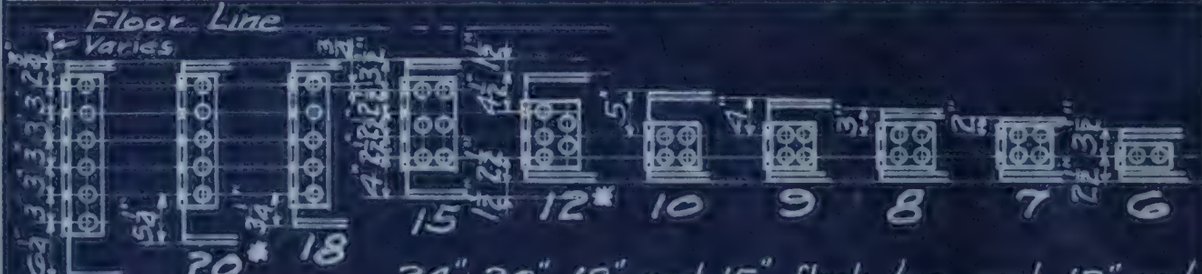
NOTE :- Where 7" I is used, special arrangement or special connection is necessary.

24", 20", 18", & 15" flush top and 12" and under flush on bottom with 15".



NOTE :- Where 7" I is used special arrangement or special connect. is necessary.

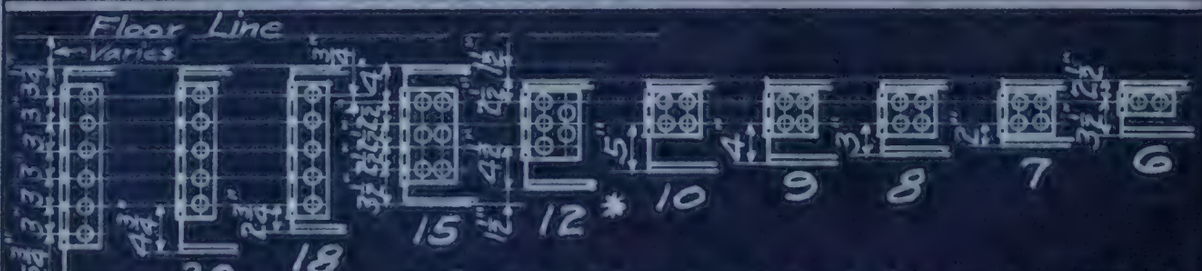
24", 20", 18", 15", and 12" flush top and 10" and under flush on bottom with 12"



24", 20", 18", and 15" flush top and 12" and under flush on bottom and 1½" above bott. of 15"

NOTE :- Where 7" I is used speal arrangement or special conn. is necessary.

All Beams flush top



24", 20", 18", and 15" flush top and 12" and under flush top and 1½" below top of other Is.

20"Is mk'd * cut conn. ⅛" for Carnegie 80# to 100# ; Pencoyd 75# to 100#

18" " * " " ¼" " " —— ; " 65# " 70#

12" " * " " ½" " " —— ; " 50# " 65#

- A.B.Co's Standard -
As Approved - 6-5-10

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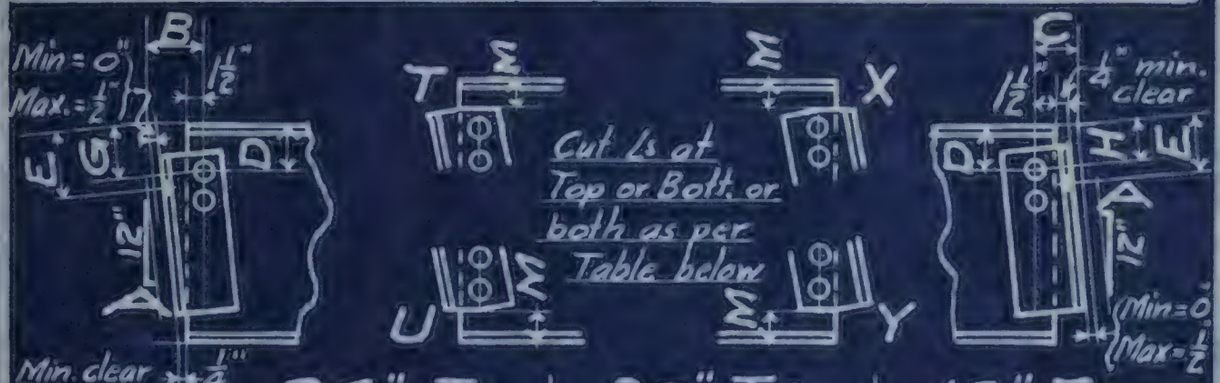
B5.018 a

Conns. for Beams with Beveled Ends.



	24" Is	20" Is	18" Is
Length of Ls	$17\frac{1}{2}$" + (G-E) when E<G	$14\frac{1}{2}$" + (G-E) when E<G	$14\frac{1}{2}$" + (G-E) when E<G
do	$17\frac{1}{2}$" + (E-G) " E>G	$14\frac{1}{2}$" + (E-G) " E>G	$14\frac{1}{2}$" + (E-G) " E>G
do	$17\frac{1}{2}$" + (H-E) " E<H	$14\frac{1}{2}$" + (H-E) " E<H	$14\frac{1}{2}$" + (H-E) " E<H
do	$17\frac{1}{2}$" + (E-H) " E>H	$14\frac{1}{2}$" + (E-H) " E>H	$14\frac{1}{2}$" + (E-H) " E>H
— D —	Min. $2\frac{3}{4}$" ; Max. $6\frac{1}{4}$"	Min $2\frac{3}{4}$" ; Max $5\frac{1}{4}$"	Min. $2\frac{1}{2}$" ; Max. $3\frac{1}{2}$"
— E —	" $2\frac{3}{4}$" ; " $6\frac{1}{4}$"	" $2\frac{3}{4}$" ; " $5\frac{1}{4}$"	" $2\frac{1}{2}$" ; " $3\frac{1}{2}$"
— M —	$1\frac{1}{2}$"	$1\frac{3}{4}$"	$1\frac{1}{2}$"

Std punching and sq. ends on beams can not be used when bevel "A" exceeds max. given below for each size of beam.

For bevels marked * drawings will show bevel but Shop will use sq. punched angles. Omit figures when these angles can be standard.

Size of Ls used		4"×4"×7/16" Ls						6"×4"×7/16" Ls												
Bevel "A"		1/8	1/4	3/8	1/2	5/8	3/4	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	1 7/8	2	2 1/8	2 1/4
24" Is	B	3	3 1/8	3 1/4	3 3/8	3 1/2		4 1/4	4 3/8	5	5 1/8	5 1/4	5 3/8	5 1/2	5 5/8	5 3/4				
	G=D+	0	1/16	1/8	1/8	3/16		5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	13/16				
	Cut T D<	—	2 1/16	2 1/2	2 1/16	2 1/16		2 1/16	2 1/16	2 1/16	2 1/16	2 1/16	2 1/16	2 1/16	2 1/16	2 1/16				
	when E<	2 1/2	2 3/8	2 3/8	2 1/2	3		3 3/16	3 1/4	3 1/4	3 3/8	3 7/16	3 1/2	3 9/16	3 5/8	3 3/4				
	Cut U D>	—	—	6 3/16	6 3/16	6 3/16		6 1/8	6 1/8	6 1/8	6 1/16	6	6	6	5 3/8					
	when																			
	C	2 3/4	2 5/8	2 1/2	2 3/8	2 1/4		3 1/4	3 1/8	3	2 7/8	2 3/4	2 5/8	2 1/2	2 3/8	2 1/4				
	H=D-	0	1/16	1/16	1/8	1/8		3/16	1/4	1/4	1/4	5/16	5/16	3/8	3/8	3/8				
	Cut X D<	—	2 1/16	2 1/16	2 1/16	2 1/16		2 1/16	2 1/16	2 1/16	2 1/16	2 1/16	2 1/16	2 1/16	3	3				
	when																			
	Cut Y D>	—	—	6 1/16	6 1/16	6 1/16		6 1/8	6 1/8	6 1/8	6 1/8	6 1/16	6 1/16	6 1/16	6 1/16	6 1/16				
	when E>	6 1/16	6 1/8	6 1/16	6 1/16	6		5 7/8	5 13/16	5 3/4	5 11/16	5 5/8	5 9/16	5 1/2	5 7/16	5 3/8				
20" Is	B	2 7/8	3	3 1/16	3 1/16	3 1/16		4 1/2	4 5/8	4 3/4	4 7/8	4 15/16	5 1/16	5 1/16	5 1/16	5 1/16	5 1/2	5 5/8		
	G=D+	0	1/16	1/8	1/8	3/16		5/16	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	13/16	7/8		
	Cut T D<	3	3	3 1/16	3 1/16	3 1/16		3 1/8	3 1/8	3 1/16	3 1/16	3 1/16	3 1/16	3 1/16	3 1/16	3 1/4	3 1/4	3 1/4		
	when E<	3	3 1/8	3 1/16	3 1/16	3 1/4		3 1/16	3 1/16	3 1/16	3 1/16	3 1/8	3 1/4	3 3/8	3 1/2	4	4 1/16	4 1/8		
	Cut U D>	5	4 1/2	4 1/2	4 1/2	4 1/2		4 3/8	4 3/8	4 3/8	4 1/2	4 1/2	4 1/2	4 3/8	4 3/8	4 3/8	4 3/8	4 3/8		
	when E>	5	5	5 1/16	5 1/16	5 1/16		5 1/16	5 1/16											
	C	2 5/8	2 1/2	2 7/16	2 3/8	2 1/4		3 5/16	3 1/4	3 1/16	3	2 7/8	2 3/4	2 5/8	2 9/16	2 1/2	2 3/8	2 1/4		
	H=D-	0	1/16	1/16	1/8	1/8		1/4	1/4	1/4	5/16	5/16	5/16	3/8	3/8	3/8	7/16	7/16		
	Cut X D<	3	3	3 1/16	3 1/16	3 1/16		3 1/16	3 1/8	3 1/8	3 1/8	3 1/16	3 1/16	3 1/16	3 1/16	3 1/4	3 1/4	3 1/4		
	when E<	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2		2 7/8	2 7/8	2 7/8	2 7/8	2 7/8	2 7/8	2 7/8	2 7/8	2 7/8	2 7/8	2 7/8		
	Cut Y D>	4 1/2	4 1/2	4 1/2	4 1/2	4 3/8		4 7/8	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	4 1/4	4 1/4	4 1/4	4 1/4		
	when E>	4 1/2	4 3/8	4 1/2	4 1/2	4 3/8		4 5/8	4 1/16	4 1/2	4 7/16	4 1/2	4 5/16	4 1/4	4 1/4	4 1/4	4 1/4	4 1/8		
18" Is	B	2 7/8	3	3 1/16	3 1/16	3 1/16	3 1/16		4 3/4	4 7/8	4 15/16	5 1/16	5 1/8	5 1/16	5 1/16	5 1/16	5 1/16	5 1/2	5 5/8	5 11/16
	G=D+	0	1/16	1/16	1/8	3/16	3/16		5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	13/16	7/8	15/16	1
	Cut T D<	2 1/4	2 1/16	2 1/16	2 1/16	2 1/16	2 1/16		2 1/16	2 1/16	2 1/16	2 1/16	2 1/16	2 1/16	2 1/16	2 1/16	2 1/16	2 1/16	2 1/16	2 1/16
	when E<	2 1/16	2 1/16	2 1/16	2 1/16	3	3 1/16		3 1/4	3 5/16	3 3/8	3 7/16	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2
	Cut U D>	3 1/4	3 1/2	3 1/16	3 1/16	3 1/16	3 1/8		3 1/8	3 1/8	3 1/8	3 1/16	3 1/16	3	3	3	3	2 15/16	2 15/16	2 15/16
	when E>	3 5/16	3 5/16	3 5/16	3 5/16	3 5/16	3 5/16													
	C	2 11/16	2 5/8	2 1/2	2 7/16	2 5/16	2 1/4		3 7/16	3 3/8	3 1/4	3 1/16	3	2 7/8	2 13/16	2 11/16	2 5/8	2 1/2	2 7/16	2 5/16
	H=D-	0	1/16	1/16	1/8	1/8	1/8		1/4	5/16	5/16	3/8	3/8	3/8	7/16	7/16	7/16	1/2	1/2	1/2
	Cut X D<	2 3/4	2 3/4	2 13/16	2 13/16	2 13/16	2 7/8		2 7/8	2 7/8	2 15/16	2 15/16	2 15/16	3	3	3	3	3 1/16	3 1/16	3 1/16
	when E<	2 11/16	2 11/16	2 11/16	2 11/16	2 11/16	2 11/16		2 15/16	2 15/16	2 15/16	2 15/16	2 15/16	2 15/16	2 15/16	2 15/16	2 15/16	2 15/16	2 15/16	2 15/16
	Cut Y D>	3 1/4	3 3/16	3 3/16	3 3/16	3 3/16	3 3/16		3 1/8	3 1/16	3 1/16	3 1/16	3 1/16	3 1/16	3	3	3	3	3	3
	when E>	3 3/16	3 1/16	3 1/8	3 1/16	3	3		2 13/16	2 3/4	2 11/16	2 11/16	2 5/8	2 9/16	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2

C.A.R. Co's Standard.
As Approved, 3-30-09.

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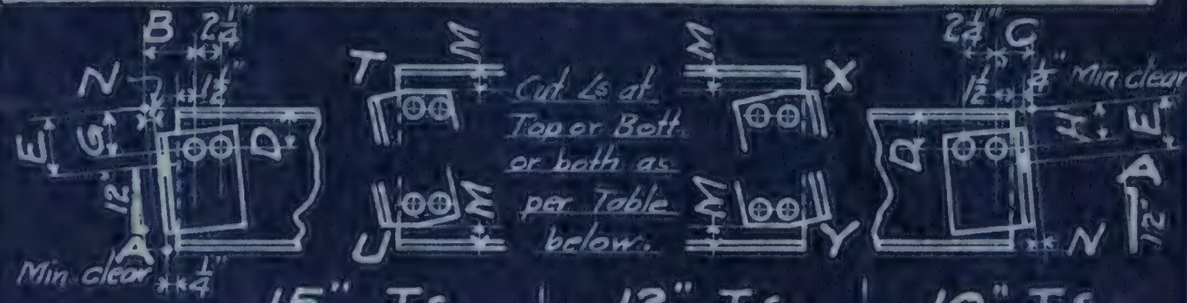
J.A.A. 12.1.10.

CONNS. FOR BEAMS WITH BEVELED ENDS.



	15" Is	12" Is	10" Is
Length of Ls	$10\frac{1}{4}$" + (G-E) when E<G	$7\frac{1}{2}$" + (G-E) when E<G	$5\frac{1}{4}$" + (G-E) when E<G
do	$10\frac{1}{4}$" + (E-G) " E>G	$7\frac{1}{2}$" + (E-G) " E>G	$5\frac{1}{4}$" + (E-G) " E>G
do	$10\frac{1}{4}$" + (H-E) " E<H	$7\frac{1}{2}$" + (H-E) " E<H	$5\frac{1}{4}$" + (H-E) " E<H
do	$10\frac{1}{4}$" + (E-H) " E>H	$7\frac{1}{2}$" + (E-H) " E>H	$5\frac{1}{4}$" + (E-H) " E>H
~ D ~	Min. $3\frac{1}{4}$" ; Max. $4\frac{1}{4}$"	Min. $2\frac{1}{2}$" ; Max. $4\frac{1}{2}$"	Min. $2\frac{1}{2}$" ; Max. 5"
~ E ~	" $3\frac{1}{4}$" ; " $4\frac{1}{4}$"	" $2\frac{1}{2}$" ; " $4\frac{1}{2}$"	" $2\frac{1}{2}$" ; " 5"
~ M ~	" $1\frac{3}{8}$" ; "	" $1\frac{1}{2}$" ; "	" $1\frac{1}{4}$" ; "
~ N ~	" 0" ; " $\frac{1}{2}$"	" 0" ; " $\frac{3}{8}$"	" 0" ; " $\frac{3}{8}$"

Std. punching and sq. ends on beams can not be used when bevel "A" exceeds max. given below for each size of beam.

For Bevels of $\frac{1}{8}$" for 15", $\frac{1}{8}$", $\frac{1}{4}$" for 12", $\frac{1}{8}$", $\frac{1}{4}$", $\frac{3}{8}$" for 10", drawings will show bevel but Shop will use sq. punched angles. Omit figures when these angles can be standard.

Size of Ls used			G" × 4" × 7/16" Ls													
Bevel "A"			$\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1	$1\frac{1}{8}$	$1\frac{1}{4}$	$1\frac{3}{8}$	$1\frac{1}{2}$	$1\frac{5}{8}$	$1\frac{3}{4}$
15" Is	B		2 15/16	3	3 1/8	3 3/16	3 1/4	3 5/16	3 3/8	3 1/2						
	G = D+		0	1/16	1/8	1/4	3/16	3/16	1/4	1/4						
	Cut "T" when	D<								3 5/16						
		E<				3 5/16	3 3/8	3 7/16	3 1/2	3 9/16						
	Cut "U" when	D	NOTE:- Ends of conn. Ls used on beams under 75* per ft need not be clipped.													
		E														
	C		2 13/16	2 11/16	2 5/8	2 9/16	2 1/2	2 3/8	2 5/16	2 1/4						
	H = D-		0	1/16	1/8	1/8	1/8	3/16	3/16	3/16						
	Cut "X" when	D	NOTE:- Ends of conn. Ls used on beams under 75* per ft need not be clipped.													
		E														
	Cut "Y" when	D>								4 3/16						
		E>					4 3/16	4 1/8	4 1/16	4						
12" Is	B		2 15/16	3	3 1/16	3 1/8	3 3/16	3 1/4	3 5/16	3 3/8	3 7/16	3 1/2	3 9/16	3 5/8		
	G = D+		0	1/16	1/8	1/8	3/16	3/16	1/4	1/4	5/16	3/8	3/8	7/16		
	Cut "T" when	D<	2 13/16	2 13/16	2 7/8	2 7/8	2 15/16	3	3	3 1/16	3 1/16	3 1/8	3 1/8	3 1/8		
		E<	2 13/16	2 7/8	2 15/16	3	3 1/8	3 3/16	3 1/4	3 5/16	3 3/8	3 7/16	3 7/16	3 9/16		
	Cut "U" when	D>	4 1/4	4 3/16	4 3/16	4 3/16	4 3/16	4 1/8	4 1/8	4 1/8	4 1/16	4 1/16	4 1/16	4 1/16		
		E>	4 1/4	4 1/4	4 1/4	4 5/16	4 5/16	4 5/16	4 3/16	4 3/16	4 3/16	4 3/16	4 1/16	4 1/16		
	C		2 13/16	2 3/4	2 11/16	2 5/8	2 9/16	2 1/2	2 7/16	2 3/8	2 5/16	2 1/4	2 3/16	2 1/8		
	H = D-		0	1/16	1/16	1/8	1/8	1/8	3/16	3/16	3/16	1/4	1/4	5/16		
	Cut "X" when	D<	2 3/4	2 13/16	2 13/16	2 13/16	2 13/16	2 7/8	2 7/8	2 7/8	2 7/8	2 15/16	2 15/16	2 15/16		
		E<	2 3/4	2 3/4	2 11/16	2 11/16	2 11/16	2 11/16	2 11/16	2 11/16	2 11/16	2 11/16	2 5/8	2 5/8		
	Cut "Y" when	D>	4 3/16	4 3/16	4 1/8	4 1/16	4 1/16	4	4	3 15/16	3 15/16	3 7/8	3 7/8	3 7/8		
		E>	4 3/16	4 1/8	4 1/16	4	3 15/16	3 7/8	3 13/16	3 3/4	3 11/16	3 5/8	3 9/16	3 1/2		
10" Is	B		2 15/16	3	3 1/16	3 1/16	3 1/8	3 3/16	3 1/4	3 5/16	3 5/16	3 3/8	3 7/16	3 1/2	3 9/16	3 5/8
	G = D+		1/16	1/16	1/16	1/8	1/8	3/16	3/16	1/4	5/16	5/16	3/8	7/16	7/16	1/2
	Cut "T" when	D<				2 9/16	2 9/16	2 5/8	2 5/8	2 5/8	2 11/16	2 3/4	2 3/4	2 13/16	2 13/16	2 15/16
		E<			2 9/16	2 5/8	2 11/16	2 13/16	2 7/8	2 15/16	3	3 1/16	3 1/8	3 3/16	3 1/4	3 5/16
	Cut "U" when	D>								4 15/16	4 15/16	4 15/16	4 15/16	4 7/8	4 7/8	4 7/8
		E>														
	C		2 13/16	2 3/4	2 11/16	2 11/16	2 5/8	2 9/16	2 1/2	2 7/16	2 7/16	2 3/8	2 5/16	2 1/4	2 3/16	2 1/8
	H = D-		0	1/16	1/16	1/16	1/8	3/16	3/16	3/16	1/4	1/4	5/16	5/16	5/16	3/8
	Cut "X" when	D<								2 9/16	2 9/16	2 9/16	2 9/16	2 5/8	2 5/8	2 5/8
		E<														
	Cut "Y" when	D>				4 15/16	4 15/16	4 7/8	4 7/8	4 7/8	4 13/16	4 3/4	4 3/4	4 11/16	4 11/16	4 11/16
		E>			4 15/16	4 7/8	4 13/16	4 3/4	4 11/16	4 5/8	4 9/16	4 1/2	4 7/16	4 3/8	4 5/16	4 1/4

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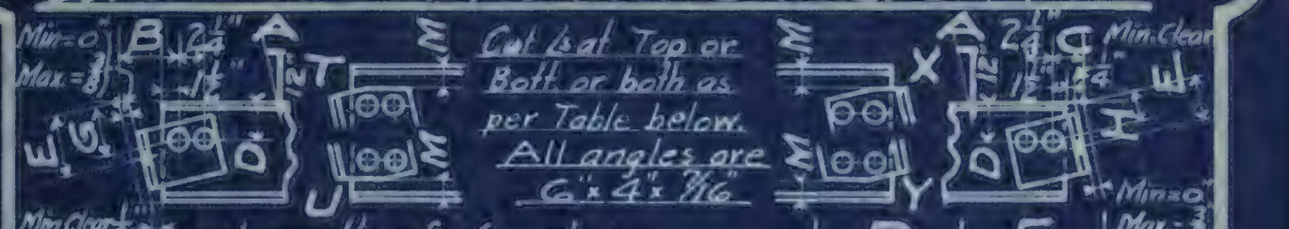
A.B.Co's Standard.
Approved:- 3-30-09

B5.018 c

CONNS. FOR BEAMS WITH BEVELED ENDS



	Length of L's when				D		E		
	E<G	E>G	E<H	E>H	Min.	Max.	Min.	Max.	M
9" Is	5¼"+(G-E)	5¼"+(E-G)	5¼"+(H-E)	5¼"+(E-H)	2½"	4"	2½"	4"	1¼"
8" Is	5¼"+(G-E)	5¼"+(E-G)	5¼"+(H-E)	5¼"+(E-H)	2"	3½"	2"	3½"	⅞"
7" Is	5¼"+(G-E)	5¼"+(E-G)	5¼"+(H-E)	5¼"+(E-H)	2"	2½"	2"	2½"	¾"
6" Is	2¾"+(G-E)	2¾"+(E-G)	2¾"+(H-E)	2¾"+(E-H)	2½"	3½"	2½"	3½"	¾"

For bevels marked * drawings will show bevel but Shop will use sq. punched angles. Omit figures when these angles can be standard. Std. punching and sq. ends on beams can not be used when bevel "A" exceeds max. given below for each size of beam.

Bevel "A"		* ⅛	* ¼	* ⅜	½	⅝	¾	⅞	1	1⅛	1¼	1⅜	1½	1⅝	1¾	1⅞	2
9" Is	B	2 9/16	2 7/8	2 15/16	3	3	3 1/16	3 1/8	3 1/8	3 3/16	3 1/4	3 5/16	3 3/8	3 3/8	3 7/16		
	G = D+	1/16	1/16	1/8	1/8	3/16	3/16	1/4	1/4	5/16	5/16	3/8	3/8	7/16	1/2		
	Cut T D< when E<	2 9/16	2 5/8	2 5/8	2 11/16	2 11/16	2 3/4	2 3/4	2 13/16	2 13/16	2 7/8	2 7/8	2 15/16	2 15/16	3		
		2 5/8	2 5/8	2 3/4	2 13/16	2 7/8	2 15/16	3	3 1/16	3 1/8	3 3/16	3 1/4	3 5/16	3 3/16	3 1/2		
	Cut U D> when E>	3 5/16	3 5/16	3 5/16	3 5/16	3 3/8	3 3/8	3 3/8	3 13/16	3 13/16	3 13/16	3 13/16	3 3/4	3 3/4	3 3/4		
	C	2 3/4	2 11/16	2 5/8	2 9/16	2 9/16	2 1/2	2 7/16	2 7/16	2 3/8	2 5/16	2 1/4	2 3/16	2 3/16	2 1/8		
	H = D-	1/16	1/16	1/8	1/8	3/16	3/16	3/16	1/4	1/4	1/4	5/16	5/16	3/8	3/8		
	Cut X D< when E<	2 9/16	2 9/16	2 11/16	2 9/16	2 5/8	2 5/8	2 5/8	2 5/8	2 11/16	2 11/16	2 11/16	2 3/4	2 7/16	2 3/4		
	Cut Y D> when E>	3 5/16	3 3/8	3 7/8	3 13/16	3 13/16	3 3/4	3 7/16	3 11/16	3 5/8	3 5/8	3 5/8	3 11/16	3 1/2	3 1/2		
		3 3/8	3 3/8	3 3/4	3 11/16	3 5/8	3 9/16	3 1/2	3 7/16	3 7/16	3 3/8	3 5/16	3 1/4	3 3/16	3 1/2		
8" Is	B	2 3/4	2 13/16	2 13/16	2 7/8	2 15/16	2 15/16	3	3 1/16	3 1/16	3 1/8	3 3/16	3 3/16	3 1/4	3 5/16		
	G = D+	1/16	1/16	1/8	1/8	1/8	3/16	1/4	1/4	5/16	5/16	3/8	3/8	7/16	7/16		
	Cut T D< when E<	2 3/16	2 3/16	2 1/4	2 1/4	2 5/16	2 3/8	2 3/8	2 7/16	2 7/16	2 1/2	2 1/2	2 9/16	2 5/8	2 5/8		
		2 3/16	2 1/4	2 9/16	2 7/16	2 1/2	2 9/16	2 5/8	2 11/16	2 3/4	2 13/16	2 3/8	2 15/16	3	3 1/8		
	Cut U D> when E>	3 5/16	3 5/16	3 3/16	3 5/16	3 1/4	3 1/4	3 1/4	3 1/4	3 3/16	3 3/16	3 3/16	3 3/8	3 1/8	3 1/16		
		3 3/8	3 3/8	3 3/8	3 3/8	3 7/16	3 7/16	3 3/16									
	C	2 1/16	2 5/8	2 11/16	2 3/16	2 1/2	2 7/16	2 7/16	2 3/8	2 5/16	2 5/16	2 1/4	2 3/16	2 3/16	2 1/8		
	H = D-	1/16	1/16	1/8	1/8	1/8	3/16	3/16	1/4	1/4	1/4	5/16	5/16	5/16	5/16		
	Cut X D< when E<	2 1/8	2 3/16	2 3/16	2 1/4	2 1/8	2 1/4	2 1/4	2 1/4	2 5/16	2 5/16	2 5/16	2 3/8	2 3/8	2 3/8		
		2 1/8	2 1/8	2 1/8	2 1/8	2 1/16	2 1/16	2 1/16									
	Cut Y D> when E>	3 5/16	3 5/16	3 1/4	3 1/4	3 3/16	3 1/8	3 1/8	3 1/16	3 1/16	3	3	2 15/16	2 7/8	2 7/8		
		3 5/16	3 1/4	3 3/16	3 1/8	3 1/16	3	2 15/16	2 7/8	2 13/16	2 3/4	2 11/16	2 5/8	2 9/16	2 1/2		
7" Is	B	2 3/4	2 3/16	2 7/16	2 7/8	2 7/8	2 15/16	2 15/16	3	3	3 1/16	3 1/8	3 1/8	3 3/16	3 3/16	3 1/4	3 5/16
	G = D+	1/16	1/16	1/8	1/8	3/16	3/16	1/4	1/4	5/16	5/16	7/8	3/8	7/16	7/16	1/2	1/2
	Cut T D< when E<	2 1/16	2 1/8	2 1/8	2 3/16	2 3/16	2 1/4	2 1/4	2 5/16	2 5/16	2 3/8	2 3/8	2 7/16	2 7/16	2 7/16	2 7/16	2 7/16
		2 1/16	2 1/8	2 1/8	2 3/16	2 3/16	2 7/16										
	Cut U D> when E	2 7/16	2 7/16	2 7/16	2 3/8	2 3/8	2 3/8	2 3/8	2 3/8	2 3/8	2 5/16	2 5/16	2 5/16	2 1/4	2 1/16	2 3/16	2 3/16
	C	2 1/16	2 5/8	2 5/8	2 1/16	2 1/2	2 1/2	2 7/16	2 7/16	2 3/8	2 3/8	2 5/16	2 1/4	2 1/4	2 3/16	2 3/16	2 1/8
	H = D-	1/16	1/16	1/8	1/8	1/8	3/16	3/16	3/16	1/4	1/4	5/16	5/16	5/16	5/16	3/8	3/8
	Cut X D< when E	2 1/16	2 1/16	2 1/16	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8	2 3/16	2 3/16	2 3/16	2 1/4	2 1/4	2 1/4	2 5/16	2 5/16
	Cut Y D> when E>	2 7/16	2 3/8	2 3/8	2 3/8	2 5/16	2 1/4	2 1/4	2 3/16	2 3/16	2 1/8	2 1/8	2 1/16	2 1/16	2 1/16	2 1/16	2 1/16
		2 7/16	2 3/8	2 5/16	2 1/4	2 3/16	2 1/8	2 1/16	2 1/16	2 1/16	2 1/16	2 1/16	2 1/16	2 1/16	2 1/16	2 1/16	2 1/16
6" Is	B	2 5/8	2 11/16	2 11/16	2 3/4	2 3/4	2 13/16	2 13/16	2 7/8	2 7/8	2 15/16	3	3	3 1/16	3 1/16	3 1/8	
	G = D+	1/16	1/16	1/8	1/8	1/8	3/16	3/16	1/4	1/4	5/16	5/16	3/8	3/8	7/16	1/2	1/2
	Cut T D< when E<															2 11/16	2 5/8
									2 9/16	2 5/8	2 11/16	2 3/4	2 7/8	2 15/16	3	3 1/16	3 1/8
	Cut U D when E																
	C	2 11/16	2 3/16	2 1/2	2 1/2	2 7/16	2 7/16	2 3/8	2 3/8	2 5/16	2 5/16	2 1/4	2 1/4	2 7/16	2 3/16	2 1/8	2 1/8
	H = D-	1/16	1/16	1/16	1/8	1/8	3/16	3/16	1/4	1/4	1/4	5/16	5/16	5/16	7/8	3/8	3/8
	Cut X D when E																
	Cut Y D> when E>															3 7/16	3 3/8
									3 7/16	3 3/8	3 5/16	3 1/4	3 3/16	3 1/8	3 1/16	3 1/16	3

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O. F. & P. Co's Standard
No. 1 Approved 3-20-09

- A.B.Co's Standard -

As Approved;- 3-30-'09

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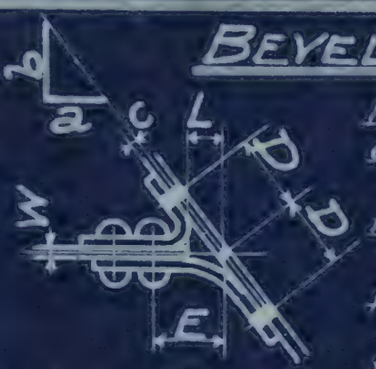
BEVELED BEAM CONNECTIONS

Where "a" = 3" or less in 12" use bent angles.
" "a" = over 3" in 12" use bent plates.



For bevels 12" or less in 12", "W" varies from $\frac{3}{8}$" to $1\frac{1}{8}$" and "C" varies from $\frac{3}{16}$" to $\frac{9}{16}$". For other cases see below.

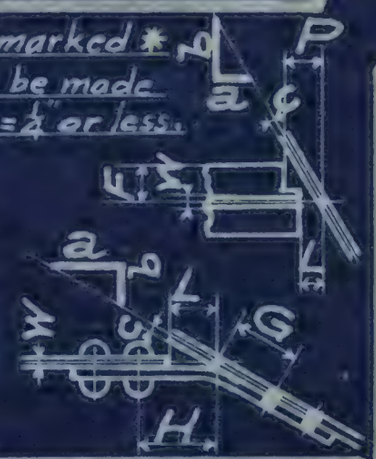
Where large no. of beams are involved, these details should be modified where necessary to meet requirements of machine riveting.

These details also apply to [5] where back of ⊔ is working line, provided web of ⊔ does not exceed $\frac{9}{16}$".

These details are based upon connection plates and angles $\frac{3}{8}$" to $\frac{1}{2}$" in thickness. Use $\frac{7}{16}$" bent pl. for reactions 30000# or less; $\frac{1}{2}$" bent pl. over 30000#.

For Intermediate Bevels use nearest Bevel given in Tables.

Cuts "P" marked * are not to be made when "C" = $\frac{1}{4}$" or less.



a	b	A	B	D	E	G	H	L	P (F- from 1¾" up to and including 2¼")	P (F- from 2¼" up to and including 2¾")	P (F- from 2¾" up to and including 3¼")	P (F- from 3¼" up to and including 3¾")	Approx. Length Bent Plates: Two Sided Conn.		Approx. Length Bent Plates: One Sided Conn.
½	12	2¾	2½					1	1	1	1	* 1¼			
1	12	"	"					1	1	1	1	* 1½			
1½	12	"	"					1	1	* 1¼	* 1¼	* 1¾			
2	12	"	"					1⅛	* 1¼	* 1½	* 1½	1¾			
2½	12	2⅞	2¾					"	* "	* "	* 1¾	2			
3	12	3	"					1¼	* 1½	* 1¾	2	2			
4	12			3½	3¼	1¾	2¾	1¼	1¾	2	2¼	2¼	10¼	11½	11¾
5	12			3¾	3¾	"	3	1½	2	2¼	2½	2¾	11	12¼	12
6	12			4¼	4½	"	"	"	2¼	2½	2¾	3	12	13¾	"
7	12			4¾	4¾	"	3¼	1¾	2½	2¾	3	3¼	12¼	14¼	12¼
8	12			5¼	5½	"	"	"	2¾	3	3½	3¾	13	15½	"
9	12					"	"	"	3	3¼	3¾	4¼			"
10	12					"	3½	2	3¼	3½	4	4½			12½
11	12					"	"	"	"	3¾	4¼	4¾			"
12	12					"	3¾	2¼	3½	4	4¾	5¼			12¾
12	11	For these bevels				1¾	2¾	1¼	3¼	4	4½	5			11¾
12	10	"W" is not more than ½"				"	3	1½	3½	4¼	4¾	5½			12
12	9	"C" " " " " ¼"				"	"	"	4	4¾	5½	6¼			12¼
12	8	For heavier Webs				"	3¼	1¾	4½	5½	6¼	7			12½
12	7	increase distances "H"				"	3½	2	5¼	6¼	7	8			12¾
12	6	"L" and "P" or make				"	3¾	2¼	6¼	7¼	8¼	9¼			13
12	5	layouts				"	4	2½	7¼	8½	9¾	11			13¼
12	4					"	4¾	3¼	8½	10¼	11¾	13½			14

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SAFE LOADS IN TONS UNIFORMLY DISTRIBUTED FOR PENCOYD I BEAMS

For Safe Loads below Heavy Line the Deflection is greater than allowable for Plastered Ceilings.

Beams Size in inches	Wt in lbs	Length in Feet																			
		12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
24	80	78.20	72.18	67.03	62.56	58.65	55.20	52.13	49.39	46.92	44.69	42.65	40.80	39.10	37.54	36.09	34.76	33.51	32.36	31.28	30.27	29.33
24	85	88.80	74.58	69.26	64.64	60.60	57.03	53.87	51.03	48.46	46.17	44.07	42.16	40.40	38.79	37.29	35.91	34.63	33.44	32.32	31.28	30.30
24	90	87.29	80.57	74.82	69.83	65.47	61.61	58.19	55.13	52.37	49.88	47.61	45.54	43.64	41.90	40.29	38.79	37.41	36.12	34.92	33.79	32.73
24	95	89.89	82.98	77.05	71.91	67.42	63.45	59.93	56.77	53.93	51.37	49.03	46.90	44.94	43.15	41.49	39.95	38.52	37.20	35.96	34.80	33.71
24	100	92.49	85.38	79.28	73.99	69.37	65.29	61.66	58.42	55.50	52.85	50.45	48.26	46.25	44.40	42.69	41.11	39.64	38.27	37.00	35.80	34.68
20	65	52.43	48.40	44.94	41.95	39.33	37.01	34.95	33.11	31.46	29.96	28.60	27.36	26.22	25.17	24.20	23.30	22.47	21.70	20.97	20.30	19.66
20	70	54.63	50.42	46.82	43.70	40.97	38.56	36.42	34.50	32.78	31.21	29.80	28.50	27.31	26.22	25.21	24.28	23.41	22.60	21.85	21.14	20.48
20	75	56.79	52.42	48.68	45.43	42.59	40.08	37.86	35.87	34.07	32.45	30.98	29.63	28.39	27.26	26.21	25.24	24.33	23.50	22.72	21.98	21.30
20	80	62.42	57.62	53.50	49.93	46.81	44.06	41.61	39.42	37.45	35.67	34.05	32.57	31.21	29.96	28.81	27.74	26.75	25.83	24.97	24.16	23.41
20	85	64.58	59.61	55.36	51.67	48.44	45.59	43.06	40.79	38.75	36.90	35.23	33.69	32.29	31.00	29.81	28.70	27.68	26.72	25.83	25.00	24.22
20	90	66.74	61.61	57.21	53.39	50.06	47.11	44.50	42.15	40.05	38.14	36.41	34.82	33.37	32.04	30.80	29.66	28.60	27.62	26.70	25.84	25.03
20	95	72.00	66.47	61.72	57.60	54.00	50.83	48.00	45.48	43.20	41.15	39.28	37.57	36.00	34.56	33.23	32.00	30.86	29.79	28.80	27.87	27.00
20	100	74.15	68.44	63.56	59.32	55.61	52.34	49.43	46.83	44.49	42.37	40.44	38.69	37.07	35.59	34.22	32.95	31.78	30.68	29.66	28.70	27.81
18	55	39.95	36.88	34.24	31.96	29.97	28.20	26.64	25.23	23.97	22.83	21.79	20.85	19.98	19.18	18.44	17.76	17.12	16.53	15.98	15.47	14.98
18	60	41.97	38.74	35.98	33.58	31.48	29.63	27.98	26.51	25.18	23.98	22.89	21.90	20.99	20.15	19.37	18.65	17.99	17.37	16.79	16.25	15.74
18	65	43.94	40.56	37.66	35.15	32.95	31.01	29.29	27.75	26.36	25.11	23.97	22.92	21.97	21.09	20.28	19.53	18.83	18.18	17.58	17.01	16.48
18	70	48.48	44.75	41.55	38.78	36.36	34.22	32.32	30.62	29.09	27.70	26.44	25.29	24.24	23.27	22.38	21.55	20.78	20.06	19.39	18.77	18.18
18	75	50.54	46.66	43.32	40.44	37.91	35.68	33.70	31.92	30.33	28.88	27.57	26.37	25.27	24.26	23.33	22.46	21.66	20.91	20.22	19.57	18.95
18	80	52.51	48.47	45.01	42.01	39.38	37.07	35.01	33.17	31.51	30.01	28.64	27.40	26.26	25.21	24.24	23.34	22.51	21.73	21.01	20.33	19.69
18	85	57.49	53.07	49.28	45.99	43.12	40.58	38.33	36.31	34.49	32.85	31.36	29.99	28.75	27.60	26.53	25.55	24.64	23.79	23.00	22.25	21.56
18	90	59.41	54.84	50.92	47.53	44.56	41.94	39.61	37.52	35.65	33.95	32.41	31.00	29.70	28.52	27.42	26.40	25.46	24.58	23.76	23.00	22.28

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SAFE LOADS IN TONS UNIFORMLY DISTRIBUTED FOR PENCOYD BEAMS

For Safe Loads below Heavy Line, the Deflection is greater than allowable for Plastered Ceilings.

Beams Size Inches	Wt. in lbs.	Length of Span in Feet. 10	11	12	13	14	15	16	17	18	19	20	21	22	24	26	28	30
15	42.	31.55	28.68	26.29	24.27	22.54	21.04	19.72	18.56	17.53	16.61	15.78	15.03	14.34	13.15	12.14	11.27	10.52
15	45.	31.16	29.76	27.28	25.18	23.38	21.82	20.46	19.25	18.18	17.23	16.37	15.59	14.88	13.64	12.59	11.69	10.91
15	50.	35.14	33.31	30.53	28.18	26.17	24.43	22.90	21.55	20.35	19.28	18.32	17.45	16.65	15.27	14.09	13.09	12.21
15	55.	38.60	35.09	32.17	29.69	27.57	25.74	24.13	22.71	21.45	20.32	19.30	18.38	17.55	16.08	14.85	13.79	12.87
15	60.	44.02	40.02	36.68	33.86	31.44	29.35	27.51	25.84	24.46	23.17	22.01	20.96	20.01	18.34	16.93	15.72	14.67
15	65.	45.98	41.80	38.32	35.37	32.84	30.65	28.74	27.05	25.54	24.20	22.99	21.89	20.90	19.16	17.68	16.42	15.33
15	70.	51.11	46.46	42.59	39.31	36.51	34.07	31.94	30.06	28.39	26.90	25.55	24.34	23.23	21.30	19.66	18.25	17.04
15	75.	53.05	48.23	44.21	40.81	37.89	35.37	33.16	31.20	29.47	27.92	26.52	25.26	24.11	22.10	20.40	18.95	17.68
15	80.	55.03	50.03	45.86	42.33	39.31	36.69	34.39	32.37	30.57	28.96	27.51	26.20	25.01	22.93	21.17	19.65	18.34
12	31.5	19.49	17.67	16.20	14.95	13.89	12.96	12.15	11.44	10.80	10.23	9.72	9.26	8.84	8.10	7.48	6.94	6.48
12	35.	20.53	18.66	17.11	15.79	14.66	13.69	12.83	12.08	11.41	10.80	10.26	9.78	9.33	8.55	7.90	7.33	6.84
12	40.	24.92	22.20	20.35	18.78	17.44	16.28	15.26	14.36	13.56	12.85	12.21	11.63	11.10	10.17	9.39	8.72	8.14
12	45.	25.98	23.62	21.65	19.98	18.56	17.32	16.24	15.28	14.43	13.67	12.99	12.37	11.81	10.82	9.99	9.28	8.66
12	50.	29.52	26.83	24.60	22.71	21.08	19.68	18.45	17.36	16.40	15.54	14.76	14.06	13.42	12.30	11.35	10.54	9.84
12	55.	32.72	29.74	27.26	25.17	23.37	21.81	20.45	19.24	18.17	17.22	16.36	15.58	14.87	13.63	12.58	11.68	10.91
12	60.	34.29	31.17	28.58	26.38	24.49	22.86	21.43	20.17	19.05	18.05	17.15	16.33	15.59	14.29	13.19	12.25	11.43
12	65.	35.87	32.61	29.89	27.59	25.62	23.91	22.42	21.10	19.93	18.88	17.93	17.08	16.30	14.94	13.79	12.81	11.96

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SAFE LOADS IN TONS UNIFORMLY DISTRIBUTED FOR PENCOYD BEAMS.

For Safe Loads below Heavy Line, the Deflection is greater than allowable for Plastered Ceilings

Beams Size in Inches	Wt in lbs.	Length of Span in Feet 5	6	7	8	9	10	11	12	13	14	15	16	17	18	20	22	24
10	25	26.26	21.88	18.76	16.40	14.60	13.13	11.93	10.94	10.10	9.38	8.75	8.20	7.72	7.29	6.56	5.97	5.47
10	30	26.63	24.08	20.63	18.06	16.05	14.44	13.13	12.04	11.11	10.32	9.63	9.03	8.50	8.02	7.22	6.57	6.02
10	35	34.80	29.00	24.86	21.75	19.34	17.40	15.82	14.50	13.39	12.43	11.60	10.88	10.24	9.67	8.70	7.91	7.25
10	40	37.44	31.20	26.74	23.40	20.80	18.72	17.02	15.60	14.41	13.37	12.48	11.70	11.01	10.40	9.36	8.51	7.80
9	21	20.14	16.78	14.37	12.59	11.19	10.07	9.15	8.39	7.74	7.19	6.71	6.29	5.92	5.59	5.03	4.58	4.19
9	25	22.00	18.34	15.72	13.75	12.22	11.00	10.00	9.17	8.46	7.86	7.33	6.88	6.47	6.11	5.50	5.00	4.58
9	30	24.37	20.31	17.41	15.23	13.54	12.18	11.08	10.15	9.37	8.70	8.12	7.62	7.17	6.77	6.09	5.54	5.08
9	35	26.73	22.27	19.09	16.71	14.85	13.36	12.15	11.14	10.28	9.55	8.91	8.35	7.86	7.42	6.68	6.07	5.57
8	18	15.30	12.74	10.92	9.56	8.50	7.65	6.95	6.37	5.88	5.46	5.10	4.78	4.50	4.25	3.82	3.48	3.19
8	20.5	16.25	13.62	11.67	10.22	9.08	8.17	7.43	6.81	6.29	5.84	5.45	5.11	4.81	4.54	4.09	3.71	3.41
8	23	17.39	14.49	12.42	10.87	9.66	8.70	7.90	7.25	6.69	6.21	5.80	5.43	5.11	4.83	4.35	3.95	3.62
8	25.5	18.44	15.37	13.17	11.52	10.24	9.22	8.38	7.68	7.09	6.58	6.15	5.76	5.42	5.12	4.61	4.19	3.84
7	15	11.16	9.30	7.97	6.97	6.20	5.58	5.07	4.65	4.29	3.99	3.72	3.49	3.28	3.10	2.79	2.54	2.32
7	17.5	12.06	10.05	8.62	7.54	6.70	6.03	5.48	5.03	4.64	4.31	4.02	3.77	3.55	3.35	3.02	2.74	2.51
7	20	12.97	10.81	9.26	8.11	7.20	6.48	5.89	5.40	4.99	4.63	4.32	4.06	3.81	3.60	3.24	2.95	2.70

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SAFE LOADS IN TONS UNIFORMLY DISTRIBUTED FOR PENCOYD BEAMS

For Safe Loads below Heavy Line, the Deflection is greater than allowable for Plastered Ceilings.

Beams Size in Inches	Wt in Lbs	Length of Span in Feet 4	5	6	7	8	9	10	11	12	13	14	15	16	17
6	12¼	9.82	7.86	6.55	5.61	4.91	4.36	3.93	3.57	3.27	3.02	2.81	2.62	2.45	2.31
6	14¾	10.79	8.63	7.19	6.17	5.40	4.80	4.32	3.92	3.60	3.32	3.08	2.88	2.70	2.54
6	17¼	11.78	9.42	7.85	6.73	5.89	5.23	4.71	4.28	3.93	3.62	3.37	3.14	2.94	2.77
5	9¾	6.46	5.17	4.31	3.69	3.23	2.87	2.59	2.35	2.16	1.99	1.85	1.72	1.62	1.52
5	12¼	7.29	5.83	4.86	4.16	3.64	3.24	2.91	2.65	2.43	2.24	2.08	1.94	1.82	1.71
5	14¾	8.10	6.48	5.40	4.63	4.05	3.60	3.24	2.94	2.70	2.49	2.31	2.16	2.02	1.90
4	7½	3.93	3.15	2.62	2.25	1.97	1.75	1.57	1.43	1.31	1.21	1.12	1.05	.98	.93
4	8½	4.14	3.36	2.80	2.40	2.10	1.86	1.68	1.52	1.40	1.29	1.20	1.12	1.05	.99
4	9½	4.45	3.56	2.97	2.55	2.23	1.98	1.78	1.62	1.48	1.37	1.27	1.19	1.11	1.05
4	10½	4.71	3.77	3.14	2.69	2.36	2.09	1.89	1.71	1.57	1.45	1.35	1.26	1.18	1.11
3	5½	2.16	1.73	1.44	1.23	1.08	.96	.86	.79	.72	.66	.62	.58	.54	.51
3	6½	2.35	1.88	1.57	1.34	1.17	1.04	.94	.85	.78	.72	.67	.63	.59	.55
3	7½	2.55	2.04	1.70	1.46	1.28	1.13	1.02	.93	.85	.78	.73	.68	.64	.60

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SAFE LOAD IN TONS UNIFORMILY DISTRIBUTED FOR CARNEGIE BEAMS

For Safe Loads below Heavy Line, the Deflection is greater than allowable for plastered ceilings.
Max Bending Stress - 16000 "per sq. in. Loads include weight of Beam.

Beam		Span in Feet																									
Depth	Wt.	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	26	28	30	32	34	36	38	40
27	83															57.1	54.4	51.9	49.6	47.6	43.9	40.7	38.1	35.7	33.6	31.7	30.1	28.6
24	115							109.6	101.2	94.0	87.7	82.3	77.4	73.1	69.3	65.8	62.7	59.8	57.2	54.9	50.6	47.0	43.9	41.1	38.7	36.6	34.6	32.9
24	110							106.8	98.5	91.5	85.3	80.0	75.4	71.2	67.4	64.0	61.0	58.2	55.7	53.3	49.3	45.7	42.7	40.0	37.7	35.6	33.7	32.0
24	105						113.6	104.2	96.1	89.3	83.3	78.1	73.5	69.4	65.8	62.5	59.5	56.8	54.4	52.1	48.1	44.7	41.7	39.1	36.8	34.7	32.9	31.3
24	69½													47.6	45.1	42.9	40.8	39.0	37.3	35.7	33.0	30.6	28.6	26.8	25.2	23.8	22.6	21.4
21	57½										41.6	39.0	36.7	34.7	32.8	31.2	29.7	28.4	27.1	26.0	24.0	22.3	20.8	19.5	18.4	17.3	16.4	15.6
18	46								33.4	31.1	29.0	27.2	25.6	24.2	22.9	21.7	20.7	19.8	18.9	18.1	16.7	15.5	14.5	13.6	12.8	12.1	11.5	
15	36						26.2	24.0	22.2	20.6	19.2	18.0	17.0	16.0	15.2	14.4	13.7	13.1	12.6	12.0	11.1	10.3	9.6	9.0				
12	27½				19.7	17.8	16.2	14.8	13.7	12.7	11.9	11.1	10.5	9.9	9.4	8.9	8.5	8.1	7.7	7.4	6.8							
10	22			15.2	13.5	12.2	11.1	10.1	9.4	8.7	8.1	7.6	7.2	6.8	6.4	6.1	5.8	5.5										
8	17½	13.0	11.1	9.7	8.7	7.8	7.1	6.5	6.0	5.6	5.2	4.9	4.6	4.3														

B5.0120e

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SAFE LOADS IN TONS UNIFORMLY DISTRIBUTED FOR PENCOYD CHANNELS.

For Safe Loads below Heavy Line the Deflection is greater than allowable for Plastered Ceilings.

Channel: Depth Inches	Wt. Lbs.	Length of Span in Feet: 8	9	10	11	12	13	14	15	16	17	18	20	22	24	26	28	30	32
15	33	27.66	24.58	22.13	20.12	18.44	17.02	15.81	14.75	13.83	13.14	12.29	11.07	10.06	9.22	8.51	7.90	7.38	6.92
15	35	28.66	25.48	22.93	20.85	19.11	17.64	16.38	15.29	14.33	13.46	12.74	11.47	10.42	9.55	8.82	8.19	7.64	7.17
15	40	31.11	27.66	24.89	22.63	20.74	19.15	17.78	16.59	15.56	14.64	13.83	12.45	11.31	10.37	9.57	8.89	8.30	7.78
15	45	33.56	29.83	26.85	24.41	22.38	20.65	19.18	17.90	16.78	15.80	14.92	13.43	12.20	11.19	10.33	9.59	8.95	8.39
15	50	39.32	34.95	31.45	28.59	26.21	24.19	22.47	20.97	19.66	18.50	17.47	15.73	14.30	13.11	12.10	11.23	10.48	9.83
15	55	41.76	37.12	33.41	30.37	27.84	25.70	23.87	22.27	20.88	19.66	18.56	16.71	15.19	13.92	12.85	11.93	11.14	10.44
13	31.9	24.44	21.72	19.55	17.77	16.29	15.04	13.96	13.03	12.22	11.49	10.86	9.78	8.89	8.15	7.52	6.98	6.51	6.11
to	40.5	31.41	27.92	25.13	22.85	20.94	19.33	17.95	16.75	15.71	14.79	13.96	12.57	11.42	10.47	9.67	8.97	8.37	7.85
12	20.5	14.36	12.76	11.49	10.45	9.58	8.84	8.21	7.66	7.18	6.76	6.38	5.75	5.22	4.79	4.42	4.10	3.83	3.59
12	25.0	16.12	14.33	12.90	11.73	10.75	9.92	9.21	8.60	8.06	5.59	7.17	6.45	5.86	5.37	4.96	4.61	4.30	4.03
12	30	18.09	16.08	14.47	13.16	12.06	11.13	10.34	9.65	9.05	8.51	8.04	7.24	6.58	6.03	5.57	5.17	4.83	4.52
12	35	23.08	20.51	18.46	16.78	15.38	14.20	13.19	12.31	11.54	10.87	10.26	9.23	8.39	7.69	7.10	6.59	6.15	5.77
12	40	25.03	22.25	20.02	18.20	16.69	15.40	14.30	13.35	12.51	11.74	11.12	10.01	9.10	8.34	7.70	7.15	6.67	6.26
12	20.5	13.78	12.24	11.02	10.02	9.18	8.48	7.87	7.35	6.89	6.49	6.12	5.51	5.01	4.59	4.24	3.94	3.67	3.44
12	32.0	18.26	16.23	14.60	13.28	12.17	11.23	10.43	9.74	9.13	8.93	8.11	7.30	6.64	6.09	5.62	5.22	4.87	4.56
10	15	8.94	7.95	7.16	6.51	5.97	5.51	5.11	4.77	4.47	4.21	3.98	3.58	3.25	2.98	2.75	2.56	2.39	2.24
10	20	10.58	9.41	8.47	7.70	7.05	6.51	6.05	5.64	5.29	4.98	4.70	4.23	3.85	3.53	3.26	3.02	2.82	2.65
10	25	13.35	11.87	10.68	9.71	8.90	8.21	7.63	7.12	6.67	6.28	5.93	5.34	4.85	4.45	4.11	3.81	3.56	3.34
10	30	14.98	13.32	11.99	10.90	9.99	9.22	8.56	7.99	7.49	7.05	6.66	5.99	5.45	4.99	4.61	4.28	4.00	3.75
10	35	16.61	14.77	13.29	12.08	11.08	10.22	9.49	8.86	8.31	7.82	7.38	6.65	6.04	5.54	5.11	4.75	4.43	4.15
9	13.25	7.10	6.31	5.68	5.16	4.73	4.37	4.05	3.78	3.55	3.34	3.15	2.84	2.58	2.37	2.18	2.03	1.89	1.77
9	15.0	7.61	6.76	6.09	5.53	5.07	4.68	4.35	4.06	3.80	3.58	3.38	3.04	2.77	2.54	2.34	2.17	2.03	1.90
9	20	9.92	8.82	7.94	7.22	6.61	6.11	5.67	5.29	4.96	4.57	4.41	3.97	3.61	3.31	3.05	2.83	2.65	2.48
9	25	11.40	10.13	9.12	8.29	7.60	7.01	6.51	6.08	5.70	5.37	5.07	4.56	4.14	3.80	3.51	3.26	3.04	2.85
9	20.3	10.40	9.24	8.32	7.56	6.93	6.40	5.94	5.54	5.20	4.89	4.62	4.16	3.78	3.47	3.20	2.97	2.77	2.60
to	28.0	12.65	11.25	10.12	9.20	8.44	7.79	7.23	6.75	6.33	5.96	5.62	5.06	4.60	4.22	3.89	3.61	3.37	3.16

B5.0121.a

Pencoyd

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SAFE LOADS IN TON UNIFORMLY DISTRIBUTED FOR PENCOYD CHANNELS.

For Safe Loads below Heavy Line, the Deflection is greater than allowable for Plastered Ceilings.

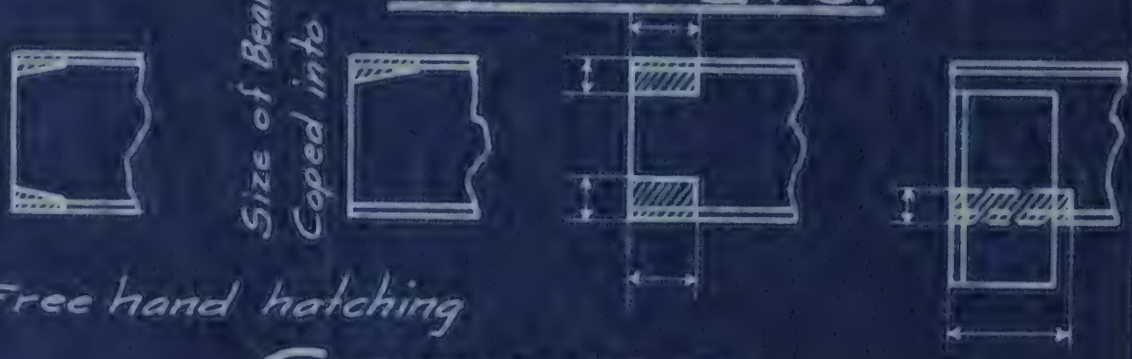
Channels Size in Inches	Wt. per Ft.	Length of Span in Feet													
		5	6	7	8	9	10	11	12	13	14	15	16	18	20
8	11.25	8.66	7.22	6.19	5.42	4.82	4.33	3.94	3.61	3.32	3.10	2.89	2.71	2.35	1.99
8	13.75	9.71	8.10	6.94	6.07	5.40	4.86	4.41	4.05	3.73	3.47	3.24	3.04	2.68	2.37
8	16.25	11.73	9.78	8.38	7.33	6.52	5.87	5.34	4.89	4.52	4.19	3.92	3.67	3.23	2.79
8	18.75	12.78	10.65	9.13	7.99	7.10	6.39	5.81	5.33	4.93	4.56	4.25	3.99	3.53	3.09
8	21.25	13.83	11.52	9.88	8.64	7.68	6.91	6.28	5.76	5.33	4.94	4.61	4.32	3.80	3.29
7	9.75	6.51	5.43	4.65	4.07	3.62	3.26	2.96	2.71	2.51	2.33	2.17	2.04	1.83	
7	12.25	7.43	6.19	5.31	4.64	4.13	3.71	3.38	3.09	2.87	2.65	2.48	2.32	2.06	
7	14.75	9.10	7.58	6.50	5.69	5.05	4.55	4.13	3.79	3.49	3.25	3.03	2.84	2.52	
7	17.25	10.01	8.34	7.15	6.26	5.57	5.01	4.55	4.17	3.86	3.58	3.34	3.13	2.79	
7	19.75	10.92	9.10	7.80	6.83	6.06	5.46	4.96	4.55	4.19	3.90	3.64	3.41	3.02	
6	8.00	4.65	3.87	3.32	2.90	2.58	2.32	2.12	1.94	1.80	1.66	1.55	1.45		
6	10.50	5.77	4.81	4.12	3.61	3.21	2.89	2.62	2.40	2.22	2.06	1.92	1.80		
6	13.00	6.55	5.46	4.68	4.10	3.64	3.28	2.98	2.73	2.50	2.34	2.26	2.05		
6	15.50	7.34	6.12	5.24	4.59	4.07	3.67	3.34	3.06	2.83	2.62	2.45	2.29		
6	15.10	8.94	7.45	6.39	5.59	4.95	4.47	4.05	3.73	3.42	3.19	2.86	2.79		
6.06	17.10	9.80	8.17	7.00	6.13	5.59	4.90	4.43	4.08	3.75	3.50	3.25	3.06		
5	6.50	3.14	2.62	2.25	1.97	1.75	1.57	1.43	1.31	1.23	1.12	1.05	.98		
5	9.00	3.80	3.16	2.71	2.37	2.11	1.90	1.73	1.58	1.48	1.36	1.27	1.19		
5	11.50	4.45	3.71	3.18	2.78	2.48	2.23	2.03	1.85	1.73	1.59	1.49	1.39		
4	5.25	1.99	1.66	1.42	1.25	1.10	1.00	.91	.83	.78	.71	.67	.62		
4	6.25	2.20	1.84	1.57	1.38	1.22	1.10	1.00	.92	.86	.79	.74	.69		
4	7.25	2.41	2.01	1.72	1.51	1.35	1.21	1.10	1.00	.94	.86	.80	.75		
3	4.00	1.14	.95	.82	.72	.63	.57	.52	.48	.43	.41	.39	.36		
3	5.00	1.30	1.08	.93	.81	.72	.65	.59	.54	.49	.46	.44	.41		
3	6.00	1.46	1.21	1.04	.91	.81	.73	.66	.61	.57	.52	.49	.46		

B5.0121 b

Pencoyd

B5.0130a

DIMENSIONS FOR COPING ETC.
STD. METHODS OF REPRESENTING COPES ETC.



Free hand hatching

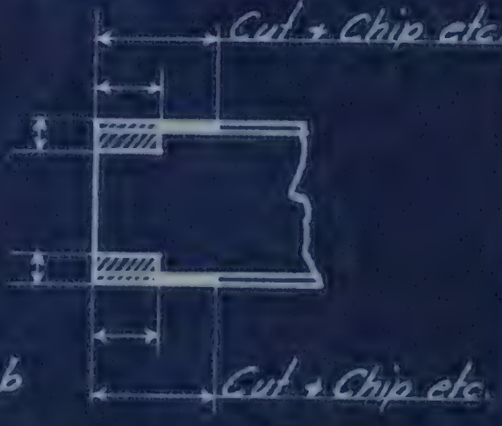
COPINGS

Cut + Chip Top + Bott - far + near sides or
Cut not Chip Top + Bott - far + near sides or
" " " " " far (or near) side
etc.

Cut + Chip (or not Chip) far (or near) side

Always note the above on drawing where flange cutting is required

FLANGE CUTS



See General Note Sheet B5.0130b

COPES AND FLANGE CUTS

FLANGE CUT ONE SIDE - HOLES OPPOSITE

SET-BACKS

A.B.Co's Standard
As Approved:- 3-30-21

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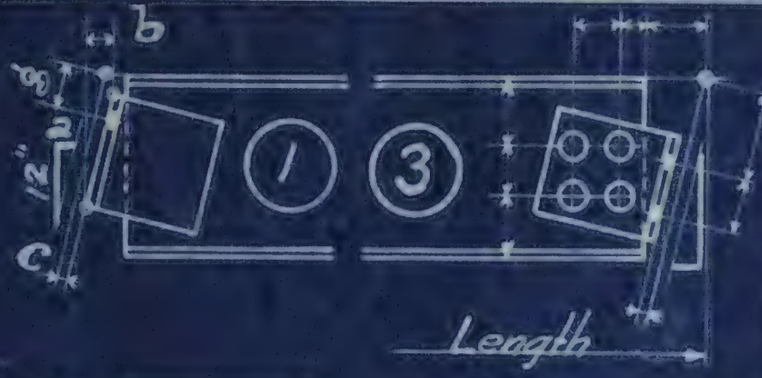
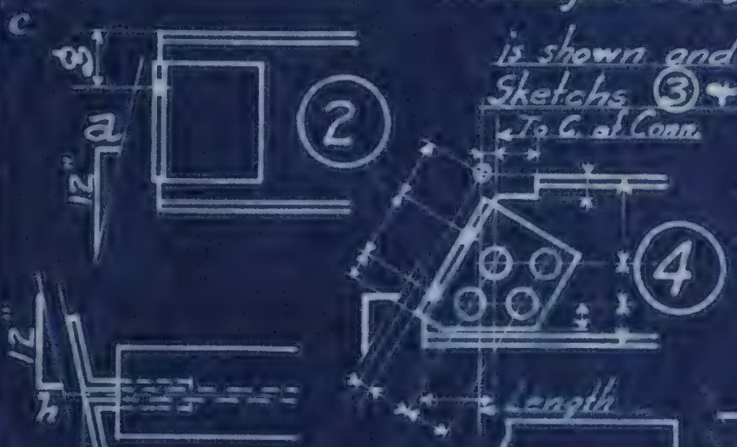
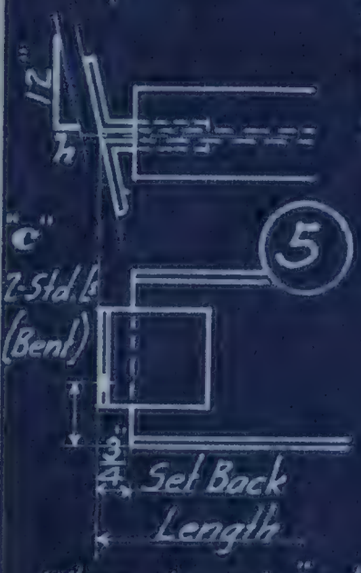
VERTICAL AND HORIZONTAL BEVELS



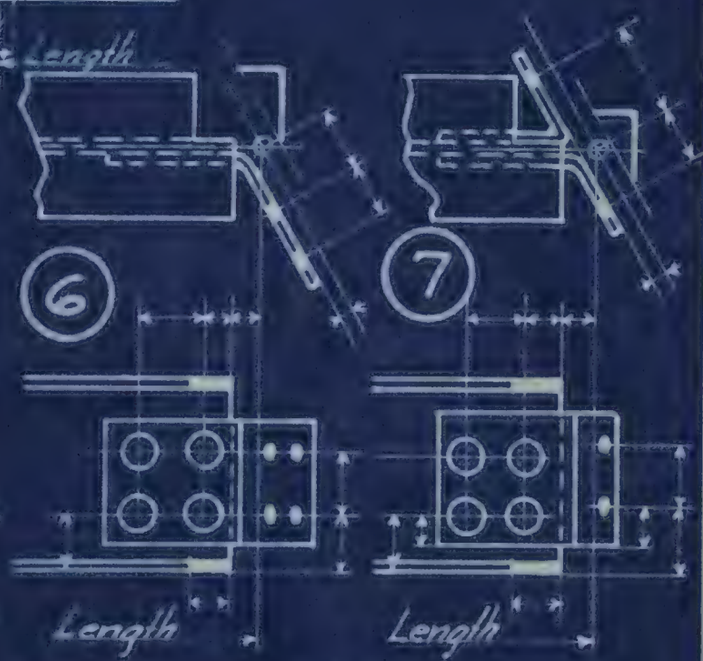
When "b", in Sketch ①, is ¼" or less, consider "c" & "3" the same as for square ends and show as in Sketch ② (Sta. sq. sketch with bevel). Otherwise the Bevel is shown and dimentioned as in Sketchs ③ & ④.



In Sketch ②, the shop will take care of the Bevel in assembling.



Where beam is "Set Back" as in ⑤, order material for a 1" set back so as to make allowance for any overrun in the cutting.



When Bevel "h" is 3" or less and Thickness of Web ⅝" or less, figure Length of Beam face to face of angles the same as for square ends, set the end of the beam back ¾", and call for Standard Angles Bent as in Sketch ⑤ Flanges over 6" wide are to have inner flange clocked ½" when "h" is 2½" to 3".

When Bevel "h" is greater than 3", show and dimension as shown in Sketches ⑥ & ⑦.

COPES – Copes are shown cross hatched as on B5.0130 a when printed beam sketches are used. Otherwise the cope is shown "cut out" as in Sketch 4. Flange cut and Set Backs are shown in any case as on B5.0130 a. The dimention of a cope lengthwise to the beam is given from the End of the Beam when Beam is cut square with no clips or with clips when clips are beveled or when Beam is "Set Back"; from the C.L. of the "working rivet" or hole as in Sketch 4 (see B5.0130 c) when Beam is cut on a bevel; and from the face of the clips when the clips are square.

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A.A.C.O.'s Standard.
As Approved, 6-1-13

GENERAL NOTES FOR BEAMS

The Working Point of Channels for Framing Connections is always taken at the Center Line of the Web but for Plans, the Back of the Channel is always used.

Beams are to be figured for a variation of ± ½" in length from the ordered length. Drawing should always show clearly what variation is allowable for each beam except beams with clips at both ends and for wall bearing beams as the detail itself, in these cases, determines the allowable variation.

Always indicate a wall bearing end of a beam.

COPES – Copes for Is and Cs are standard for each depth of beam regardless of weight except for 15" Is which are divided into "Heavy" & "Light". If the framing beams are of the same depth and flush top, copes will be shown but not noted except for 15" Is which must be noted "Heavy" or "Light". Otherwise always note size of beam coped into except where cope becomes a "block" when the dimensions are all that is needed.

END CONNECTION ANGLES – For Standard Connection Angles, shown on Sheet B5.013a, a skeleton sketch (no rivets shown) with either the top or bottom open hole shown and dimensioned to top or bottom, respectively, of beam is all that is needed. If one Standard Angle is needed, call for "1 Std. L". If one sided Std. 6"×6" L is needed, the letter "M" will indicate same.

All connections that are not Std., must be fully detailed, that is all open holes and rivets shown and dimensioned, and billed at least once on each sheet and given an assembling mark which mark will also identify other alike pieces on the same sheet. For beams with beveled end connections where working point falls outside of beam, the first rivet or hole in end connection must be tied up to the working point by dimensions lengthwise and crosswise to the beam.

WEB AND FLANGE PUNCHING – Always give the distance from the top or bottom of beam to the first hole of any group of holes. The standard spacing for a group of holes crosswise of beam is 2½" and lengthwise of beam is 5½" and need not be given on drawing. All other spacings must be given. Also all groups of holes or rivets must be dimensioned to the left end of beam and in complicated beams the distance C. to C. of each group must be given also. This distance to the left must be given from the working point of any group of holes or rivets or from the back of an angle connection (L riveted to beam) to the end of beam if beam is cut square with no end clips or with end clips and clips beveled or clips set square and end of beam "Set Back"; to the face of the end clips if beam has end clips set square; or to the dimensioned hole or rivet at the end of beam if the end of beam is beveled.

A continuous line of rivets or holes, such as for a skewback angle, need not be dimensioned to the left end but if a group of rivets or holes for a connection break into such a line, the rivets or holes in the line nearest to the group must be tied up to the working point of the group. If holes are for spiking pieces they must be so noted.

Where spacing crosswise of beam has got to suit the Multiple Punch, use std. clips where possible. Otherwise always use special clips instead of passing beam through the punch twice. This can most generally be done except in complicated skew work. Tie Rod holes can generally be moved up or down to fit the other punchings. Where possible, always put the holes of a connection square in the beam and bevel the same in the connection angles.

GIRDERS – Beams in pairs with separators, if shipped knocked down, must be detailed separately as must the separators & bolts; if shipped assembled, detail beams together, bill as girders, call for separators and bolts which are to be detailed on separate sheets and noted "Send to shop for assembling", and give reference to the sheets of separators and bolts.

A.E.C.O.'s Standard. As Approved: 3-30-29

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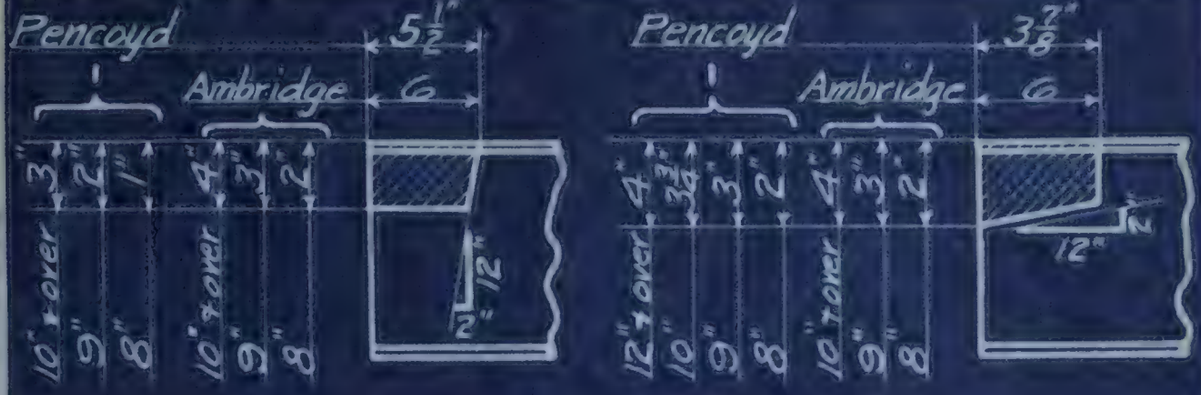
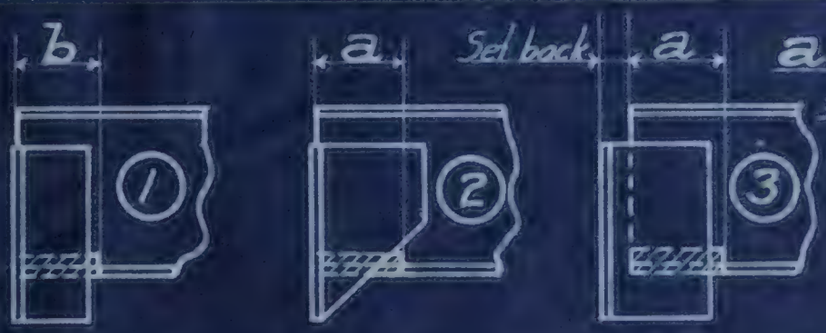
COPING, CUTTING & SAWING BEAMS



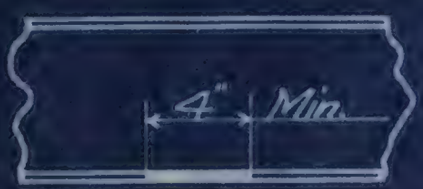
MAX. COPES



a = Max. cope
= 5½" - Pencoyd
= 6 - Ambridge

When this type of detail is used, avoid cutting and chipping flanges by coping beam, provided distance "b" from end of beam can be made = or < "a", sketch (1). When a large no. of beams are involved and 6" conn. ∠s are used, cope dist. "a" and clip ∠s, sketch (2); or cope dist "a" and set beam back, sketch (3); or cope dist. "a" and cut + chip balance of dist. required.

When necessary to cut part of the flange, always cut entire flange as per sketch (4), not as in sketch (5). When thus cut, marked "Cut not Chip", there is a projection of ¼" of metal beyond the web, sketch (6).



Min. cut is 4" except at ends of beam.

This can only be sawed and punched.

Ex 3.a.a
11-18-10

A.B.C.'s Standard.
As Approved 3-30-09
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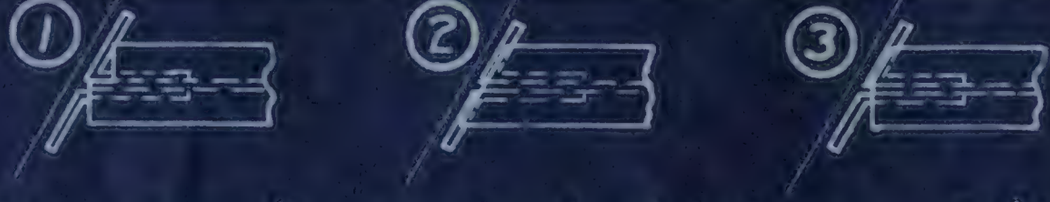
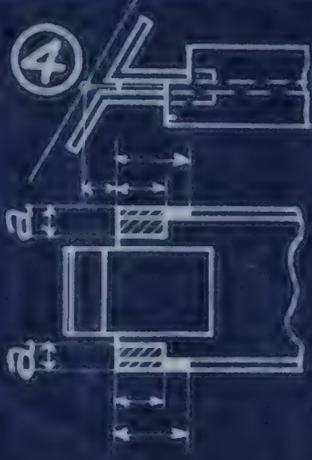
COPING, CUTTING & SAWING BEAMS



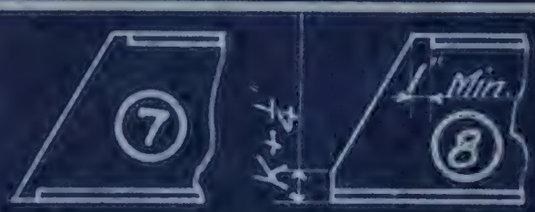
Beams connecting on a bevel, detail as per sketch ①. Never detail as per sketches ② & ③ as this requires the beams to be sawed.



For beams framing on a bevel, flush top or bottom or both use square copes and dimension same. Also give size of beam framed into.

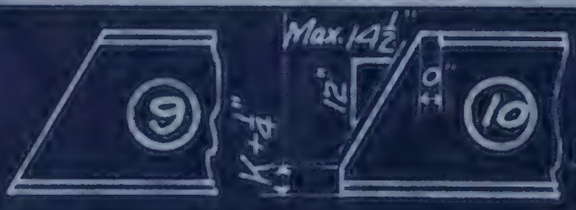
"a" can be made equal to "k" of beam framed into, but should not be less.

Avoid cutting beams with beveled ends as per sketch ⑤ as they must be tipped up on a bevel in order to saw them. Use detail as per sketch ⑥. See below.



FOR AMBRIDGE

Beams detailed as per sketch ⑦ & ⑧ will be cut not sawed. All Beams will be cut.



FOR PENCOYD

Beams detailed as per sketch ⑨ are sawed. Beams detailed as per sketch ⑩ can be cut by special knives. These special knives are only used when a large number of beams are involved; so, when there is a small no. involved, the beams are always sawed.

∴ When a small no. of beams are involved, detail as per sketch ⑨ and

When a large no. of beams are involved, detail as per sketch ⑩

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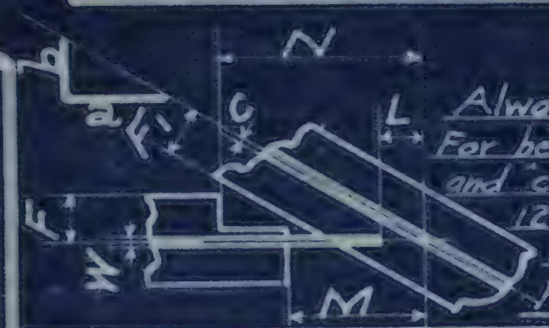
BEVELED BEAM COPING



Always give size of beam framed into.

For bevels 12" or less in 12", W varies from $\frac{3}{8}$ to $1\frac{1}{8}$" and c varies from $\frac{3}{16}$" to $\frac{9}{16}$". For bevels 12:11 to 12:4 inclusive, W is not more than $\frac{1}{2}$" and c is not more than $\frac{1}{4}$". For heavier webs, increase dist. "L"

For Intermediate Bevels, use nearest Bevel given.

"S" may be equal to "K" of beam framed into, but must not be less.

			F = 1¾ to 2¼ inc.								F = 2¼ to 2¾ inc.							
			F1 = 1¾ to 2¼ incl.		F1 = 2¼ to 2¾ incl.		F1 = 2¾ to 3¼ incl.		F1 = 3¼ to 3¾ incl.		F1 = 1¾ to 2¼ incl.		F1 = 2¼ to 2¾ incl.		F1 = 2¾ to 3¼ incl.		F1 = 3¼ to 3¾ incl.	
a	b	L	M	N	M	N	M	N	M	N	M	N	M	N	M	N	M	N
½	12	1	2½	2¾	3	3¼	3½	3¾	4	4¼	2½	2¾	3	3¼	3½	3¾	4	4¼
1	12	1	2¾	"	3¼	"	3¾	"	4¼	"	2¾	3	3¼	3½	3¾	4	4¼	4½
1½	12	1	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
2	12	1¼	"	3	"	3½	"	4	"	4½	"	"	"	"	"	"	"	"
2½	12	1¼	"	"	"	"	"	"	"	"	"	3¼	"	3¾	"	4¼	"	4¾
3	12	1¼	3	3¼	3½	3¾	4	4¼	4½	4¾	3	3½	3½	4	4	4½	4½	5
4	12	1¼	"	3½	"	4	"	4½	"	5	"	3¾	"	4¼	"	4¾	"	5¼
5	12	1½	3¼	3¾	3¾	4¼	4½	5	4¾	5½	3¼	4	3¼	4½	4¼	5	4¾	5¼
6	12	1½	"	4	"	4¾	4½	5¼	5	5¾	"	4¼	"	5	4½	5½	5	6
7	12	1¾	3½	4¼	4	5	4¾	5½	5¼	6	3½	4¾	4	5¼	4¾	5¾	5¼	6½
8	12	1¾	3¾	4½	4¼	5¼	5	5¾	5½	6½	3¾	5	4¼	5½	5	6¼	5½	6¾
9	12	1¾	"	5	4½	5½	5	6¼	5¾	7	"	5¼	4½	6	"	6½	5¾	7¼
10	12	2	4	5¼	4¾	6	5¼	6½	6	7¼	4	5½	4¾	6¼	5¼	7	6	7¾
11	12	2	4¼	5½	5	6¼	5½	7	6¼	7½	4¼	6	5	6¾	5½	7¼	6¼	8
12	12	2¼	4½	6	5¼	6¾	6	7¼	6½	8	4½	6½	5¼	7¼	6	8	6½	8½
12	11	1¼	4½	6½	5¼	7¼	6	8	6¾	8¾	4½	7	5¼	7¾	6	8½	6¼	9¼
12	10	1½	4¾	6¾	5½	7¾	6¼	8½	7	9¼	4¾	7½	5½	8¼	6¼	9	7	9¾
12	9	1½	5	7½	6	8¼	6¾	9¼	7¾	10	5	8¼	6	9	6¾	10	7¼	10¼
12	8	1¾	5½	8	6¼	9	7¼	10	8¼	10¾	5½	8¾	6¼	9¾	7¼	10¾	8¼	11½
12	7	2	6¼	9¼	7¼	10½	8¼	11½	9¼	12½	6¼	10¼	7¼	11¼	8¼	12¼	9¼	13½
12	6	2¼	7	10½	8¼	12	9¼	13¼	10½	14¼	7	12	8¼	13	9¼	14¼	10½	15½
12	5	2½	8¼	13	9¼	14½	11¼	15¾	12½	17¼	8¼	14½	9¾	15¾	11¼	17	12½	18½
12	4	3¼	9½	14½	11	16	12½	17½	14	19¼	9½	16	11	17½	12½	19	14	20½

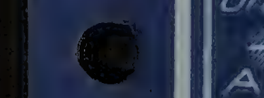
			F = 2¾ to 3¼ inc.								F = 3¼ to 3¾ inc.							
			F1 = 1¾ to 2¼ incl.		F1 = 2¼ to 2¾ incl.		F1 = 2¾ to 3¼ incl.		F1 = 3¼ to 3¾ incl.		F1 = 1¾ to 2¼ incl.		F1 = 2¼ to 2¾ incl.		F1 = 2¾ to 3¼ incl.		F1 = 3¼ to 3¾ incl.	
a	b	L	M	N	M	N	M	N	M	N	M	N	M	N	M	N	M	N
½	12	1	2½	2¾	3	3¼	3½	3¾	4	4¼	2½	2¾	3	3¼	3½	3¾	4	4¼
1	12	1	2¾	3	3¼	3½	3¾	4	4¼	4½	2¾	3	3¼	3½	3¾	4	4¼	4½
1½	12	1	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
2	12	1¼	"	3¼	"	3¾	"	4¼	"	4¾	"	3½	"	4	"	4½	"	5
2½	12	1¼	"	"	"	"	"	"	"	"	"	3¾	3½	4¼	4	4¾	4½	5¼
3	12	1¼	3	3½	3½	4	4	4½	4½	5	3	4	4	4½	4½	5	5	5½
4	12	1¼	"	3¾	"	4¼	"	4¾	"	5½	"	4½	"	5	"	5½	"	6
5	12	1½	3¼	4¼	3¾	4¾	4¼	5¼	4¾	5¾	3¼	5	4	5½	4½	6	5	6½
6	12	1½	"	4¾	"	5¼	"	5¾	"	6¼	"	5½	"	6	"	6½	6	7
7	12	1¾	3½	5	4	5½	4½	6	5	6¾	3½	6	4½	6½	5	7	6	7½
8	12	1¾	3¾	5¼	4¼	6	5	6½	5½	7	3¾	6½	4¾	7	5½	7½	6	8
9	12	1¾	"	5½	4½	6½	"	7	5½	7½	"	7	5	7½	5¾	8	6½	8½
10	12	2	4	6	4½	6¾	5¼	7½	6	8	4	7½	5¼	8	6	8½	6¾	9
11	12	2	4¼	6½	5	7¼	5½	7¾	6¼	8½	4¼	8	5½	8½	6¼	9	7	9½
12	12	2¼	4½	7	5¼	7½	6	8	6½	8½	4½	8½	5¾	9	6½	9½	7¼	10
12	11	1¼	4½	7½	5¼	8¼	6	9	6¾	9¾	4½	9	6	9½	6¾	10½	7½	11½
12	10	1½	4¾	8	5½	8¾	6¼	9¾	7	10½	4¾	9½	6¼	10	7	11	7¾	12
12	9	1½	5	8¼	6	9¾	6¾	10½	7¾	11½	5	10	6¾	10½	7½	11½	8¼	12½
12	8	1¾	5½	9¾	6¼	10½	7¼	11½	8¼	12½	5½	10½	7¼	11½	8¼	12½	9	13½
12	7	2	6¼	11¼	7¼	12¼	8¼	13¼	9¼	14¼	6¼	12¼	8¼	13	9¼	14	10¼	15½
12	6	2¼	7	13	8¼	14	9¼	15¼	10½	16½	7	14	8¼	15¼	9¼	16½	10½	17½
12	5	2½	8¼	15¾	9¾	17	11¼	18½	12½	19¾	8¼	17	9¾	18½	11¼	19¾	12½	21
12	4	3¼	9½	17½	11	19	12½	20½	14	22	9½	19	11	20½	12½	22	14	23½

B5.0132.a

BEAMS

GENERAL FORMULAE

"M" = Bending Moment in Ft. Lbs.
"w" = Deflection in Inches
l = Length in Feet.
W = Concentrated Load in Lbs.
p = Uniform Load in Lbs per Lin. Ft.
E = Coef of Elast in Lbs per Sq. In.
I = Moment of Inertia of the Normal Section of Beam - all dimentions in Ins.

Beams	Max Moment "M"	Point	Max. Deflect. "w"	Point	Contraflexure React at B	Contraflexure Points
Concntrd load	Wl	A	$576\frac{Wl^3}{EI}$	B		
Uniform load	$\frac{1}{2}pl^2$	A	$216\frac{pl^4}{EI}$	B		
Concntrd load	$\frac{1}{4}Wl$	Center	$36\frac{Wl^3}{EI}$	Center		
Uniform load	$\frac{1}{8}pl^2$	Center	$22.5\frac{pl^4}{EI}$	Center		
Concntrd load	$-\frac{3}{16}Wl$ $+\frac{5}{32}Wl$	A Center	$16.16\frac{Wl^3}{EI}$	$0.447 \times l$ from B	$\frac{5}{16}W$	$\frac{8}{11}l$ from B
Uniform load	$-\frac{1}{8}pl^2$ $+\frac{9}{128}pl^2$	A $\frac{3}{8}l$ from B	$9.35\frac{pl^4}{EI}$	$0.4215 \times l$ from B	$\frac{3}{8}pl$	$\frac{3}{4}l$ from B
Concntrd load	$-\frac{1}{8}Wl$ $+\frac{1}{8}Wl$	A Center	$9\frac{Wl^3}{EI}$	Center		$\frac{1}{4}l$ from A + B
Uniform load 	$-\frac{1}{12}pl^2$ $+\frac{1}{24}pl^2$	A Center	$4.5\frac{pl^4}{EI}$	Center		$0.211\,l$ from A + B
Uniform load	$+\frac{1}{2}\left[\left(\frac{l}{2}\right)^2-l_1^2\right]p$ $-\frac{1}{2}pl_1^2$	Center A + B			$\frac{(l+2l_1)p}{2}$ at A also	$\frac{1}{2}(l^2+4l_1^2)^{\frac{1}{2}}$ from Center

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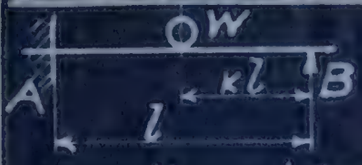
BEAMS - GENERAL FORMULAE (Continued)



Load "W" at any point distant "kl" from "B" in which "k" = any constant less than Unity.

Reaction at "B" ---------- = $\frac{1}{2} W(2 - 3k + k^3)$

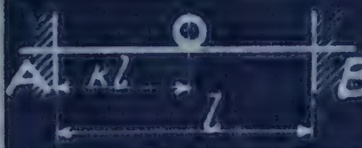
" " "A" ---------- = $\frac{1}{2} W(3k - k^3)$

Max. Pos. Mom ---------- = $\frac{1}{2} Wlk(2 - 3k + k^3)$

" Negative Mom. at "A" --- = $\frac{1}{2} Wl(k - k^3)$

Point of Contraflexure

The absolute max. deflect. occurs under load when "kl" = 0.419 l and its value = $f = \frac{16.93\ Wl^3}{EI}$



Load "W" at any point distant "kl" from "A" in which "k" = any constant less than Unity.

Reaction at "A" ---------- = $W(1 - 3k^2 + 2k^3)$

" " "B" ---------- = $Wk^2(3 - 2k)$

Mom. at "A" ---------- = $-Wlk(1 - 2k + k^2)$

" " "B" ---------- = $-Wlk^2(1 - k)$

" under load ---------- = $+Wlk^2(2 - 4k + 2k^2)$

Points of Contraflexure

Uniform Load - Overhanging Ends. "m" + "n" are constants less than Unity (For Concentrated Loads use "Moments")

Reaction at "A" ---------- = $pl(\frac{1}{2}m^2 + m + \frac{1}{2} - \frac{1}{2}n^2)$

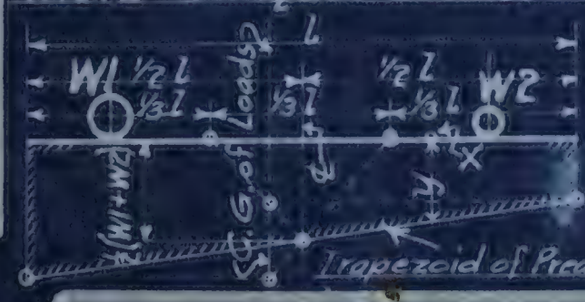
" " "B" ---------- = $pl(\frac{1}{2}n^2 + n + \frac{1}{2} - \frac{1}{2}m^2)$

Mom. at Center ---------- = $\frac{1}{4}pl^2(\frac{1}{2} - n^2 - m^2)$

" " "A" ---------- = $-\frac{1}{2}p(ml)^2$

" " "B" ---------- = $-\frac{1}{2}p(nl)^2$

Earth Preasure on Gdrs. + Beams supporting two or more Unequal Loads. — Graphical —



Divide Beam into 2 and 3 equal parts. Find Center of Gravity of Loads and the Mean Preasure per Ft. of Length. Proceed as shown. Then "y" = preasure per lin. ft. of beam at any pt. "x"

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BEAMS

GENERAL FORMULAE

EQUATIONS FOR "3 MOMENTS"

M_a = Bending Moment at A

M_b = " " " B

M_c = " " " C

$$M_a l_1 + 2M_b(l_1 + l_2) + M_c l_2 = -\frac{p_1 l_1^3 + p_2 l_2^3}{4}$$

If the beam extends over "n" supports, this theorem furnishes (n-2) equations beteween the moments at the intermediate supports. The remaining two equations necessary for solution being furnished by the terminal conditions at each end of the beam.

R_a = Partial Reaction at A

R_B = Total " " B

R_c = Partial " " C

$$R_a = \frac{1}{l_1}(M_b - M_a) + \frac{1}{2} p_1 l_1$$

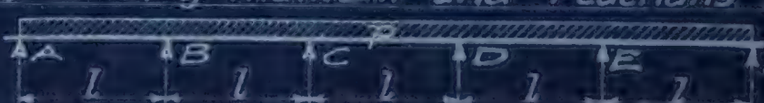
$$R_c = \frac{1}{l_2}(M_b - M_c) + \frac{1}{2} p_2 l_2$$

$$R_B = (p_1 l_1 - R_a) + (p_2 l_2 - R_c)$$

(React. at left) (React. at Right)

The reactions are thus found by dividing the beam, as far as possible into sections of two panels each and finding the reactions of each section, whether whole or half, and adding the two partial react. at each section point to obtain the total reaction for that point.

A continuous beam of 5 equal spans is uniformily loaded. Find the bending moment and reactions at the supports.



$M_a = M_f = 0$

$M_a + 4M_b + M_c = -\frac{1}{2} pl^2$; $M_b + 4M_c + M_d = -\frac{1}{2} pl^2$

$M_c + 4M_d + M_e = -\frac{1}{2} pl^2$; $M_d + 4M_e + M_f = -\frac{1}{2} pl^2$

$\therefore M_a = M_f = 0$; $M_b = M_e = -\frac{4}{38} pl^2$; $M_c = M_d = -\frac{3}{38} pl^2$

$R_a = \frac{1}{l}(M_b - M_a) + \frac{1}{2} pl = \frac{15}{38} pl$ (Sect. A-C). $\therefore$

$R_c = \frac{1}{l}(M_b - M_c) + \frac{1}{2} pl = \frac{12}{38} pl$ (") $R_A = R_F = \frac{15}{38} pl$;

$R_B = 2pl - (R_a + R_c) = \frac{43}{38} pl$ (") $R_B = R_E = \frac{43}{38} pl$;

$R_c = \frac{1}{l}(M_d - M_c) + \frac{1}{2} pl = \frac{1}{2} pl$ (Sect. CD)

and $R_c = R_D = R_c$ (Sect. A-C) $+ R_c$ (Sect. CD) $= \frac{37}{38} pl$

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BEAMS - GENERAL FORMULAE - "3-MOMENTS - (Cont.)

CO-EFFICIENTS — UNIFORM LOAD - EQUAL SPANS

Coefs. "m" for Moments at Supports for Various No. of Spans

Number of Spans							
1	0						
2	0	0					
3	0	1/8	0				
4	0	1/10	1/10	0			
5	0	3/28	2/28	3/28	0		
6	0	4/38	3/38	3/38	4/38	0	
7	0	11/104	8/104	9/104	8/104	11/104	0
	0	15/142	11/142	12/142	12/142	11/142	15/142 0

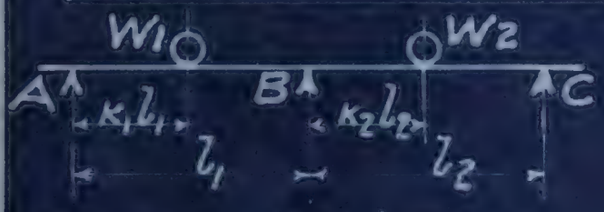
$M = -m\,pl^2$ in which "M" = Mom at supt; "m" = Coefficient; "p" = Uniform Load per lin ft; "l" = Length of Spans.

Coefs. "s" for Shears on each side of Supports for Various No. of Spans.

Number of Spans							
1	0	1/2	1/2	0			
2	0	3/8	5/8	5/8	3/8	0	
3	0	4/10	6/10	5/10	5/10	4/10	0
4	0	11/28	17/28	15/28	13/28	13/28	15/28	17/28	11/28	0
5	0	15/38	23/38	20/38	18/38	19/38	19/38	18/38	20/38	23/38	15/38	0
6	0	41/104	63/104	55/104	49/104	51/104	53/104	53/104	51/104	49/104	55/104	63/104	41/104	0
7	0	56/142	86/142	75/142	67/142	70/142	72/142	71/142	71/142	72/142	70/142	67/142	75/142	86/142	56/142	0

$S = spl$ — in which "S" = Shear at one side of support; "s" = Coef.; "p" = Uniform Load per lin ft; "l" = Length of Spans.

CONCENTRATED LOADS



For notation see Sheet B5.0141a. [Unity "K1" & "K2" are constants less than

$$M_a l_1 + 2M_b(l_1 + l_2) + M_c l_2 = -\Sigma W_1 l_1^2 (K_1 - K_1^2) - \Sigma W_2 l_2^2 (2K_2 - 3K_2^2 + K_2^3)$$

$$R_a = \tfrac{1}{l_1}(M_b - M_a) + \Sigma W_1 (l_1 - K_1 l_1)$$

$$R_c = \tfrac{1}{l_2}(M_b - M_c) + \Sigma W_2 (l_2 - K_2 l_2)$$

$$R_B = (\Sigma W_1 - R_a) + (\Sigma W_2 - R_c)$$

(Shear at Left Side) (Shear at Right Side)

BENDING MOMENT AT ANY POINT

$M = M' + R'x - \tfrac{1}{2} p x^2 - \Sigma W(x - Kl)$ in which "M" = Moment at any point dist. "x" from left support of panel considered; "M'" = Moment at left support; "R'" = Shear at the right of the left support; "p" = Uniform Load; "W" = Any concentrated load dist. "Kl" from left support; "K" = Constant less than Unity; "l" = Length of Span.

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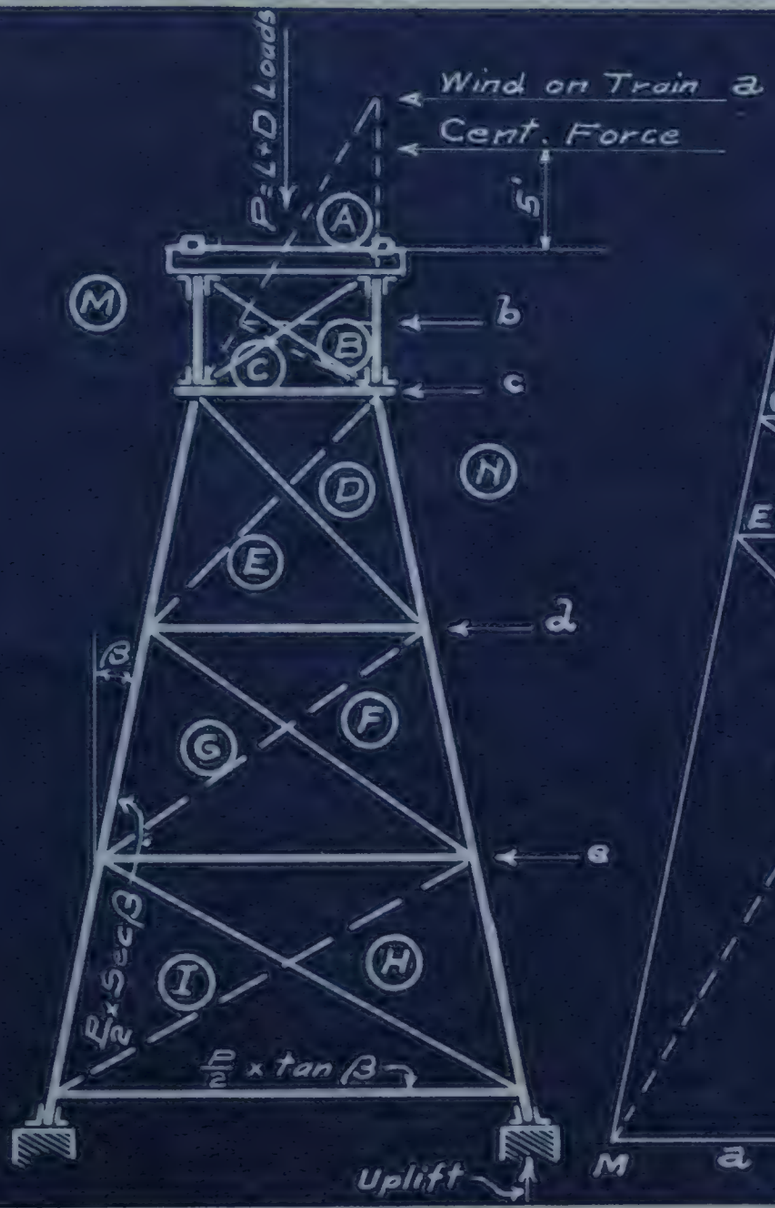
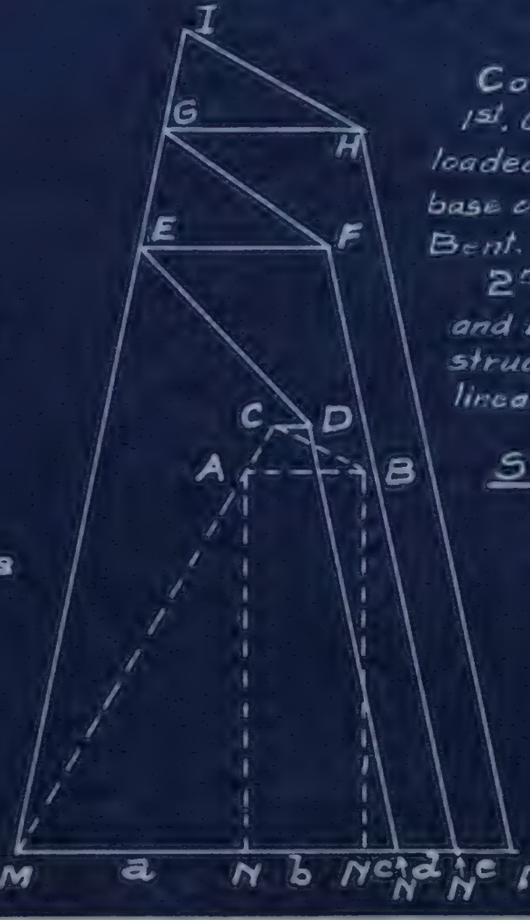
STRESSES IN A TRESSEL BENT



NOTES - a,b,c,d,e are obtained from the diff. Specif. "F" = Wind force per Vertical ft of Bent ; l = Panel length of Bent. $c = \frac{1}{2} \times F$; d & e = l x F ; Max. uplift = One track loaded with empty freight cars.



COOPERS CONDITIONS OF LOADING -

1st. One track loaded with cars only or both tracks loaded with max. train load. a = 450#, 6' above base of rail ; b = 300# ; F = 100# per vert. lineal ft. of Bent.

2nd. Both tracks unloaded - Wind load on girders and bents only. b = 500# per lineal longitudnal ft. of structure acting at C.L. of Girders ; F = 200# per vert. lineal ft. of Bent.

STRESSES IN LONGITUDINAL BRACING OF A TRESSEL TOWER

Lateral Thrust = Live x 0.2

Stress in Diags. = L x 0.2 x Sec φ

" " Struts = L x 0.2 x tan φ

B.S. 141 a

J. A. A. 12/2406

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BOLTS

All Dimensions given in Inches

Round					Head							Nut						
					Hex.		Hex Sq	Sq.				Sq.		Hex Sq	Hex.			
Dia.	Area Sq. in.	Dia at Root of Thread	Area at Root of Thread	No Thds per In.	L.D.	S.D.	T	L.D.	S.D.			L.D.	S.D.	T	L.D.	S.D.		
1/4	.049	.185	.027	20	5/8	1/2	1/4	11/16	1/2			11/16	1/2	1/4	5/8	1/2		
3/8	.110	.194	.068	16	13/16	11/16	3/8	1	11/16			1	11/16	3/8	13/16	11/16		
1/2	.196	.400	.126	13	1	7/8	7/16	1 1/4	7/8			1 1/4	7/8	1/2	1	7/8		
5/8	.307	.507	.202	11	1 1/4	1 1/16	9/16	1 1/2	1 1/16			1 1/2	1 1/16	5/8	1 1/4	1 1/16		
3/4	.442	.620	.302	10	1 7/16	1 1/4	5/8	1 13/16	1 1/4			1 13/16	1 1/4	3/4	1 7/16	1 1/4		
7/8	.601	.731	.419	9	1 11/16	1 7/16	3/4	2 1/16	1 7/16			2 1/16	1 7/16	7/8	1 11/16	1 7/16		
1	.785	.838	.551	8	1 7/8	1 5/8	13/16	2 5/16	1 5/8			2 5/16	1 5/8	1	1 7/8	1 5/8		
1 1/8	.994	.939	.693	7	2 1/8	1 13/16	15/16	2 9/16	1 13/16			2 9/16	1 13/16	1 1/8	2 1/8	1 13/16		
1 1/4	1.227	1.064	.890	7	2 5/16	2	1	2 13/16	2			2 13/16	2	1 1/4	2 5/16	2		
1 3/8	1.485	1.159	1.054	6	2 5/16	2 3/16	1 1/8	3 1/8	2 3/16			3 1/8	2 3/16	1 3/8	2 5/16	2 3/16		
1 1/2	1.767	1.284	1.294	6	2 3/4	2 3/8	1 3/16	3 3/8	2 3/8			3 3/8	2 3/8	1 1/2	2 3/4	2 3/8		
1 5/8	2.074	1.389	1.515	5 1/2	3	2 9/16	1 5/16	3 5/8	2 9/16			3 5/8	2 9/16	1 5/8	3	2 9/16		
1 3/4	2.405	1.490	1.744	5	3 3/16	2 3/4	1 3/8	3 7/8	2 3/4			3 7/8	2 3/4	1 3/4	3 3/16	2 3/4		
1 7/8	2.761	1.615	2.049	5	3 7/16	2 15/16	1 1/2	4 3/16	2 15/16			4 3/16	2 15/16	1 7/8	3 7/16	2 15/16		
2	3.142	1.711	2.300	4 1/2	3 5/8	3 1/8	1 9/16	4 7/16	3 1/8			4 7/16	3 1/8	2	3 5/8	3 1/8		
2 1/4	3.976	1.961	3.021	4 1/2	4 1/16	3 1/2	1 3/4	4 15/16	3 1/2			4 15/16	3 1/2	2 1/4	4 1/16	3 1/2		
2 1/2	4.909	2.175	3.716	4	4 1/2	3 7/8	1 15/16	5 1/2	3 7/8			5 1/2	3 7/8	2 1/2	4 1/2	3 7/8		
2 3/4	5.940	2.425	4.620	4	4 15/16	4 1/4	2 1/8	6	4 1/4			6	4 1/4	2 3/4	4 15/16	4 1/4		
3	7.069	2.629	5.428	3 1/2	5 3/8	4 5/8	2 5/16	6 1/2	4 5/8			6 1/2	4 5/8	3	5 3/8	4 5/8		
3 1/4	8.296	2.879	6.509	3 1/2	5 13/16	5	2 1/2	7 1/16	5			7 1/2	5	3 1/4	5 13/16	5		
3 1/2	9.621	3.100	7.549	3 1/4	6 1/4	5 3/8	2 11/16	7 5/8	5 3/8			7 5/8	5 3/8	3 1/2	6 1/4	5 3/8		

The Rules for Shape of Thread, No Threads per In., and Sizes for Heads & Nuts are those (commonly known as U.S. Std.) recommended by the Franklin Institute of Phil. in Dec., 1864; and are as follow

Short Dia. of Rough Nut or Rough Heads = 1½ × Diam. of Bolt + ⅛"

Thickness of Rough Nut = Dia. of Bolt

" " " Head = ½ of Dia. of Head.

SHAPE OF THREAD

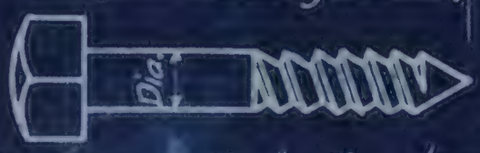
LENGTH OF THREAD

For Bolts not listed here, Length of Thread = abt 3 diams. Short Bolts threaded to ¼" from head.

Dia / Lgth	1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4
1 to 1½	3/4	3/4	1	1 1/4					
1⅝ " 2	3/4	"	"	"	1 1/2	1 1/2			
2 1/8 " 2 1/2	3/4	"	"	"	"	1 3/4	1 3/4		
2⅝ " 3	7/8	7/8	"	"	"	"	"	2 1/4	
3 1/8 " 4	"	"	1 1/4	"	"	"	"	"	2 1/2 2 3/4
4 1/8 " 8	1	1	"	1 1/2	1 3/4	2	2 1/4	2 1/2	2 3/4
8 1/8 " 12	"	"	1 1/2	1 3/4	2	2 1/4	2 1/2	3	3
12 1/8 " 20	"	"	"	2	"	"	"	"	"

B15.121 Q

LAG-SCREWS - HOOK BOLTS -



Heads are the same as for Square Head Bolts.

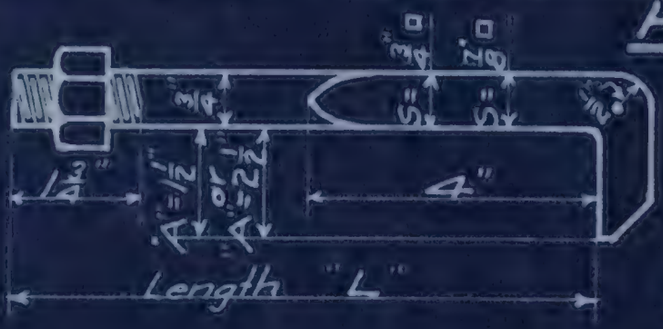
Threaded portion is not tapered except at pt.

Lag Screws $\frac{5}{16}$", $\frac{3}{4}$", $\frac{7}{8}$" are manufd. at Ambridge Plant

Diam.	Minimum Length	Max. Length	No. Thds per In.	
$\frac{5}{16}$	$1\frac{1}{2}$	6		
$\frac{3}{8}$	$1\frac{1}{2}$	6		
$\frac{7}{16}$	$1\frac{1}{2}$	8		
$\frac{1}{2}$	$1\frac{1}{2}$	10		
$\frac{9}{16}$	2	12		
$\frac{5}{8}$	2	12	5	
$\frac{3}{4}$	$2\frac{1}{2}$	12	4	
$\frac{7}{8}$	3	12	3	
1	$3\frac{1}{2}$	12		
$1\frac{1}{8}$	5	12		
$1\frac{1}{4}$	6	12		
$1\frac{1}{2}$	8	12		

Length of Screw	Length of Thread
$1\frac{1}{2}$	1
2	$1\frac{1}{4}$
$2\frac{1}{2}$	$1\frac{1}{2}$
3	$1\frac{3}{4}$
$3\frac{1}{2}$	2
4	$2\frac{1}{4}$
$4\frac{1}{2}$	$2\frac{1}{2}$
5	$2\frac{3}{4}$
$5\frac{1}{2}$	3
6	$3\frac{1}{4}$
7	$3\frac{3}{4}$
8	$4\frac{1}{4}$
9	$4\frac{3}{4}$
10	5
11	5
12	5

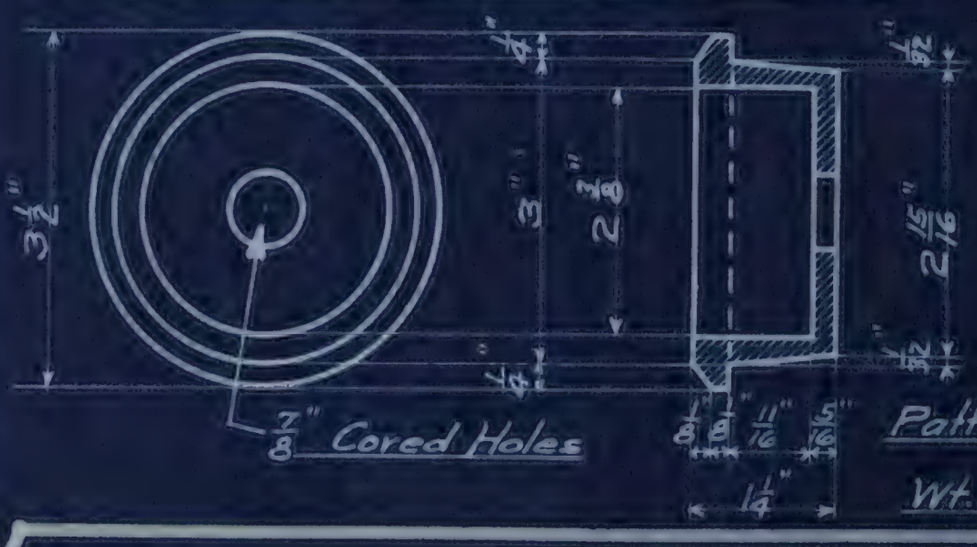
HOOK BOLTS



Unless otherwise specified, "S" will be made $\frac{3}{4}$" and Std. Hex. Nuts will be furnished.

In billing Hook Bolts, give dims. A, S, & L; all other dims. are Std.

CAST IRON CUP WASHERS



Patt. No. A141

Wt. 1.3 #

ka.a.
6 5-10.

A.R.Co's Standard.
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B15.123

Bolt Lengths for Variant Grips.

For Bolts over 12" long use Rods with a Nut at each end.

Grip	Diameter				
	1/2	5/8	3/4	7/8	1
1/2	1 1/4	1 1/4	1 1/2	1 1/2	1 3/4
5/8	"	1 1/2	"	1 3/4	"
3/4	1 1/2	"	1 3/4	"	2
7/8	"	1 3/4	"	2	"
1	1 3/4	1 3/4	2	2	2 1/4
1 1/8	"	2	"	2 1/4	"
1 1/4	2	"	2 1/4	"	2 1/2
1 3/8	"	2 1/4	"	2 1/2	"
1 1/2	2 1/4	"	2 1/2	"	2 3/4
1 5/8	"	2 1/2	"	2 3/4	"
1 3/4	2 1/2	"	2 3/4	"	3
1 7/8	"	2 3/4	"	3	"
2	2 3/4	2 3/4	3	3	3 1/4
2 1/8	"	3	"	3 1/4	"
2 1/4	3	3	3 1/4	"	3 1/2
2 3/8	"	3 1/4	"	3 1/2	"
2 1/2	3 1/4	"	3 1/2	"	3 3/4
2 5/8	"	3 1/2	"	3 3/4	"
2 3/4	3 1/2	"	3 3/4	"	4
2 7/8	"	3 3/4	"	4	"
3	4	4	4	4	4 1/2
3 1/8	"	"	"	4 1/2	"
3 1/4	"	"	4 1/2	"	"
3 3/8	"	4 1/2	"	"	"
3 1/2	4 1/2	"	"	"	5
3 5/8	"	"	"	5	"
3 3/4	"	"	5	"	"
3 7/8	"	5	"	"	"
4	5	5	5	5	5 1/2
4 1/8	"	"	"	5 1/2	"
4 1/4	"	"	5 1/2	"	"
4 3/8	"	5 1/2	"	"	"
4 1/2	5 1/2	"	"	"	6
4 5/8	"	"	"	6	"
4 3/4	"	"	6	"	"
4 7/8	"	6	"	"	"
5	6	6	6	6	6 1/2
5 1/8	"	"	"	6 1/2	"
5 1/4	"	"	6 1/2	"	"
5 3/8	"	6 1/2	"	"	"
5 1/2	6 1/2	"	"	"	7
5 5/8	"	"	"	7	"
5 3/4	"	"	7	"	"
5 7/8	"	7	"	"	"

Grip	Diameter				
	1/2	5/8	3/4	7/8	1
6	7	7	7	7	7 1/2
6 1/8	"	"	"	7 1/2	"
6 1/4	"	"	7 1/2	"	"
6 3/8	"	7 1/2	"	"	"
6 1/2	7 1/2	"	"	"	8
6 5/8	"	"	"	8	"
6 3/4	"	"	8	"	"
6 7/8	"	8	"	"	"
7	8	8	8	8	8 1/2
7 1/8	"	"	"	8 1/2	"
7 1/4	"	"	8 1/2	"	"
7 3/8	"	8 1/2	"	"	"
7 1/2	8 1/2	"	"	"	9
7 5/8	"	"	"	9	"
7 3/4	"	"	9	"	"
7 7/8	"	9	"	"	"
8	9	9	9	9	9 1/2
8 1/8	"	"	"	9 1/2	"
8 1/4	"	"	9 1/2	"	"
8 3/8	"	9 1/2	"	"	"
8 1/2	9 1/2	"	"	"	10
8 5/8	"	"	"	10	"
8 3/4	"	"	10	"	"
8 7/8	"	10	"	"	"
9	10	10	10	10	10 1/2
9 1/8	"	"	"	10 1/2	"
9 1/4	"	"	10 1/2	"	"
9 3/8	"	10 1/2	"	"	"
9 1/2	10 1/2	"	"	"	11
9 5/8	"	"	"	11	"
9 3/4	"	"	11	"	"
9 7/8	"	11	"	"	"
10	11	11	11	11	11 1/2
10 1/8	"	"	"	11 1/2	"
10 1/4	"	"	11 1/2	"	"
10 3/8	"	11 1/2	"	"	"
10 1/2	11 1/2	"	"	"	12
10 5/8	"	"	"	12	"
10 3/4	"	"	12	"	"
10 7/8	"	12	"	"	"
11	12	12	12	12	
11 1/8	"	"	"		
11 1/4	"	"			
11 3/8	"				

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A.B.Co's Standard

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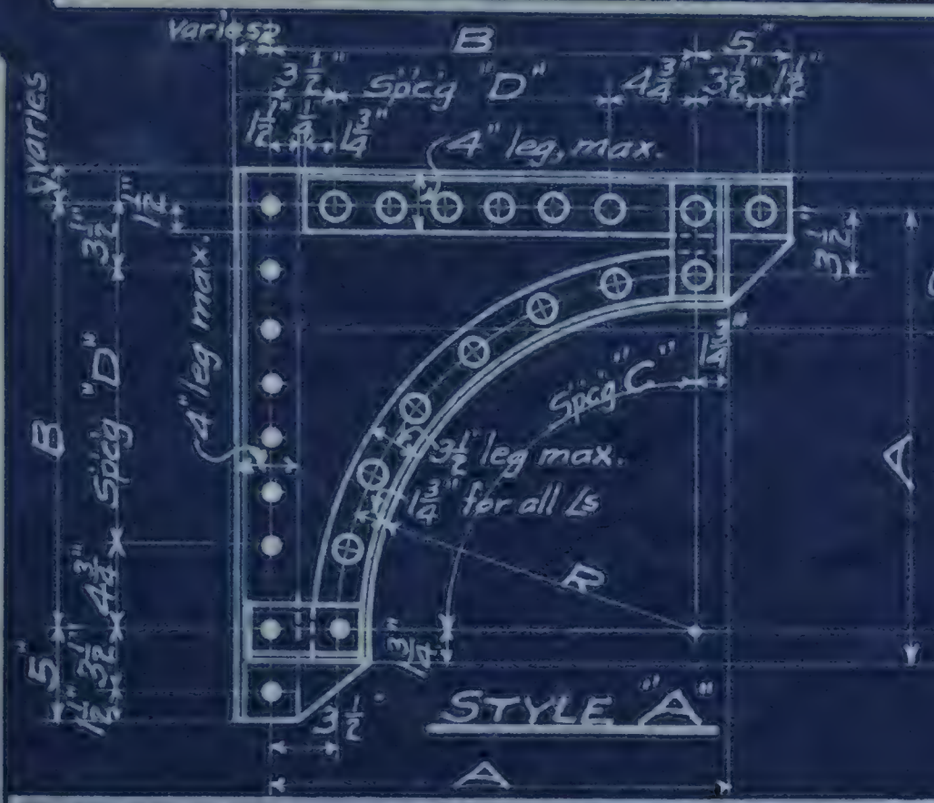
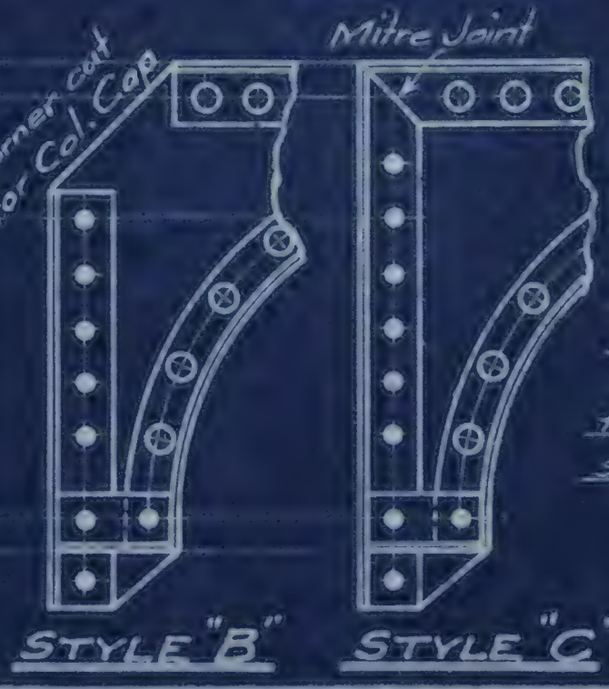
CURVED BRACKETS





Vert. Ls are milled for stiffeners under load.

For Styles "B" & "C", angles shown field riveted should be shop riveted to bracket when holes in outstanding leg are accessible for field riveting.

Dimensions given are the same for all three styles of brackets.

Radius R	A	Rivet Spacing "C"	B	Rivet Spacing "D"	Length of Quadrant L	L + 1¾	L + 3½
1'-6"	2'-1"	7 of 4⅜" about	1'-11¼"	5 of 3" = 1'-6	2'-4¼"	2'-7"	2'-9¾"
2-0	2-7	9 " 4½" "	2-5¼	7 " 3" = 1-9"	3-1 11/16	3-4 7/16	3-7 3/16
2-6	3-1	11 " 4½" "	2-11¼	9 " 3" = 2-3	3-11⅛	4-1⅞	4-4 5/8
3-0	3-7	13 " 4½" "	3-5¼	11 " 3" = 2-9	4-8 9/16	4-11 5/16	5-2 1/16
3-6	4-1	15 " 4½" "	3-11¼	13 " 3" = 3-3	5-6	5-8¾	5-11½
4-0	4-7	17 " 4½" "	4-5¼	15 " 3" = 3-9	6-3⅜	6-6⅛	6-8⅞
4-6	5-1	19 " 4½" "	4-11¼	17 " 3" = 4-3	7-0 13/16	7-3 3/16	7-6 5/16

B18.012a

CHANNELS —

Flange Widths + Web Thicknesses are given to the nearest 1/16"

Gages for Connection Angles are to be determined by the 1/2 Web Thicknesses as given below.

Max Moment is based on extreme fiber stress of 16000# per sq in. for Carnegie Sections. Moments for Pencoyd Sections approx. the same.

C	Carnegie						Pencoyd												
Depth	Weight in Lbs per Ft.	Flange	Web	½ Web	Tangent Dist t	k	For Cols. only h	Flange	Web	½ Web	Tangent Dist t	k	For Cols. only h	Max Brkg Mom. in Thos. of Ft. Lbs.	For Cols only d	Gage f	Grip b	Dist. c	Max Rivet in Flange	Std Brg. on Wall	Std Brg. Pls.
15	55	3 13/16	13/16	7/16	12 1/4	1 3/8	2 9/16	4 1/8	3/4	3/8	12	1 1/2	2 1/2	76.0	1 3/4	2 1/2	11/16	7/8	7/8	12"	12"x3 1/2"x41#
	50	3 3/4	3/4	3/8	"	"	2 1/2	4	5/8	5/16	"	"	2 3/8	72.0		"	"	13/16	"		
	45	3 5/8	5/8	5/16	"	"	2 3/8	3 5/8	"	"	12 1/4	1 3/8	"	67.0	"	2	5/8	11/16	"		
	40	3 1/2	1/2	1/4	"	"	2 5/16	3 1/2	9/16	1/4	"	"	2 5/16	62.0	"	"	"	9/16	"		
	35	3 7/16	7/16	"	"	"	2 3/16	3 7/16	7/16	"	"	"	2 3/16	57.0	"	"	"	1/2	"		
	33	3 3/8	"	3/16	"	"	2 3/16	3 3/8	"	3/16	"	"	"	56.0	"	"	"	"	"		
12	40	3 7/16	3/4	3/8	10	1	2 1/4	3 5/16	5/8	5/16	9	1 1/2	2 1/8	44.0	1 1/2	2	5/8	13/16	7/8	12"	12"x3"x31#
	35	3 5/16	5/8	5/16	"	"	2 1/8	3 3/16	1/2	1/4	"	"	2	40.0	"	"	"	11/16	"		
	30	3 3/16	1/2	1/4	"	"	2	3 1/8	"	"	10	1	"	36.0	"	1 3/4	1/2	9/16	"		
	25	3 1/16	3/8	3/16	"	"	1 7/8	3 3/16	3/8	3/16	"	"	1 15/16	32.0	"	"	"	7/16	"		
	20.5	2 15/16	5/16	1/8	"	"	1 13/16	2 15/16	5/16	1/8	"	"	1 13/16	28.0	"	"	"	3/8	"		
10	35	3 3/16	13/16	7/16	8 1/4	7/8	2 1/16	3 3/16	3/4	3/8	7 3/4	1 1/8	2	31.0	1 1/4	1 3/4	1/2	7/8	3/4	8"	8"x5 8"x1'0" WT 17#
	30	3 1/16	11/16	3/8	"	"	1 15/16	3 1/16	5/8	5/16	"	"	1 7/8	28.0	"	"	"	3/4	"		
	25	2 7/8	1/2	1/4	"	"	1 13/16	2 15/16	7/16	1/4	"	"	1 11/16	24.0	"	"	"	9/16	"		
	20	2 3/4	3/8	3/16	"	"	1 5/8	2 3/4	3/8	3/16	8 1/4	7/8	1 5/8	21.0	"	1 1/2	7/16	7/16	"		
	15	2 5/8	1/4	1/8	"	"	1 1/2	2 5/8	1/4	1/8	"	"	1 1/2	18.0	"	"	"	5/16	"		
9	25	2 13/16	5/8	5/16	7 1/4	7/8	1 3/4	2 7/8	1/2	1/4	6 3/4	1 1/8	1 11/16	21.0	1 1/8	1 1/2	1/2	11/16	3/4		8"x4 1/2"x21#
	20	2 5/8	7/16	1/4	"	"	1 9/16	2 3/4	3/8	3/16	"	"	1 1/2	18.0	"	"	"	1/2	"		
	15	2 1/2	5/16	3/16	"	"	1 7/16	2 1/2	1/4	1/8	7 1/4	7/8	1 7/16	15.0	"	1 3/8	7/16	3/8	"		
	13.25	2 7/16	1/4	1/8	"	"	1 3/8	2 7/16	"	"	"	"	1 3/8	14.0	"	"	"	5/16	"		
8	21.25	2 5/8	5/8	5/16	6 1/4	7/8	1 5/8	2 3/4	1/2	1/4	6	1	1 1/2	16.0	1	1 1/2	7/16	11/16	3/4	8"	8"x4"x18#
	18.75	2 1/2	1/2	1/4	"	"	1 1/2	2 5/8	7/16	"	"	"	1 7/16	15.0	"	"	"	9/16	"		
	16.25	2 7/16	7/16	3/16	"	"	1 7/16	2 9/16	3/8	3/16	"	"	1 3/8	13.0	"	"	"	1/2	"		
	13.75	2 3/8	5/16	"	"	"	1 5/16	2 3/8	5/16	"	6 1/4	7/8	1 5/16	12.0	"	1 3/8	3/8	3/8	"		
	11.25	2 1/4	1/4	1/8	"	"	1 1/4	2 1/4	1/4	1/8	"	"	1 1/4	11.0	"	"	"	5/16	"		
7	19.75	2 1/2	5/8	5/16	5 1/2	3/4	1 5/8	2 11/16	9/16	5/16	5 1/2	7/8	1 9/16	12.6	1	1 1/2	7/16	11/16	5/8		8"x3 1/2"x14#
	17.25	2 7/16	1/2	1/4	"	"	1 9/16	2 9/16	1/2	1/4	"	"	1 1/2	11.5	"	"	"	9/16	"		
	14.75	2 5/16	7/16	"	"	"	1 7/16	2 7/16	3/8	3/16	"	"	1 3/8	10.3	"	1 1/4	"	1/2	"		
	12.25	2 3/16	5/16	3/16	"	"	1 5/16	2 3/16	5/16	"	5 1/2	3/4	1 5/16	9.2	"	"	3/8	3/8	"		
	9.75	2 1/16	1/4	1/8	"	"	1 1/4	2 1/16	1/4	1/8	"	"	1 1/4	8.3	"	"	"	5/16	"		
6	15.5	2 5/16	9/16	5/16	4 1/2	3/4		2 3/8	1/2	1/4	4 1/2	3/4		8.7		1 3/8	3/8	5/8	5/8	6"	6"x3 1/2"x15.5#
	13	2 3/16	7/16	1/4	"	"		2 1/4	3/8	3/16	"	"		7.7		"	"	1/2	"		
	10.5	2 1/16	5/16	3/16	"	"		2 1/8	1/4	1/8	"	"		6.7		1 1/8	"	3/8	"		
	8	1 15/16	3/16	1/8	"	"		1 15/16	3/16	"	"	"		5.8		"	5/16	1/4	"		
5	11.5	2 1/16	1/2	1/4	3 3/4	5/8		2 1/8	3/8	3/16	3 1/2	3/4		5.5		1 1/8	5/16	9/16	1/2		6"x3 1/2"x9.75#
	9.	1 7/8	5/16	3/16	"	"		1 7/8	5/16	"	3 3/4	5/8		4.7		"	"	3/8	"		
	6.5	1 3/4	3/16	1/8	"	"		1 3/4	3/16	1/8	"	"		3.9		"	"	1/4	"		
4	7.25	1 3/4	5/16	3/16	2 3/4	5/8		1 3/4	5/16	3/16	2 3/4	5/8		3.0		1	5/16	3/8	1/2		
	6.25	1 5/8	1/4	1/8	"	"		1 11/16	1/4	1/8	"	"		2.8		"	"	5/16			
	5.25	1 9/16	3/16	"	"	"		1 5/8	3/16	"	"	"		2.5		"	"	1/4			
3	6	1 5/8	3/8	3/16	1 3/4	5/8		1 9/16	3/8	3/16	1 3/4	5/8		1.8		7/8	1/4	7/16	1/2		
	5	1 1/2	1/4	1/8	"	"		1 1/2	1/4	1/8	"	"		1.6		"	"	5/16	"		
	4	1 7/16	3/16	"	"	"		1 7/16	3/16	"	"	"		1.4		"	"	1/4	"		

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A.B.C.'s Standard
As Approved 3-30-07

- A.B.Co's Standard -

As Approved:- 5-13-'69.

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CLEVISES

℄ = Net Grip + 1/2"

℄' = " " + 3/4"

L = ℄ + 1"

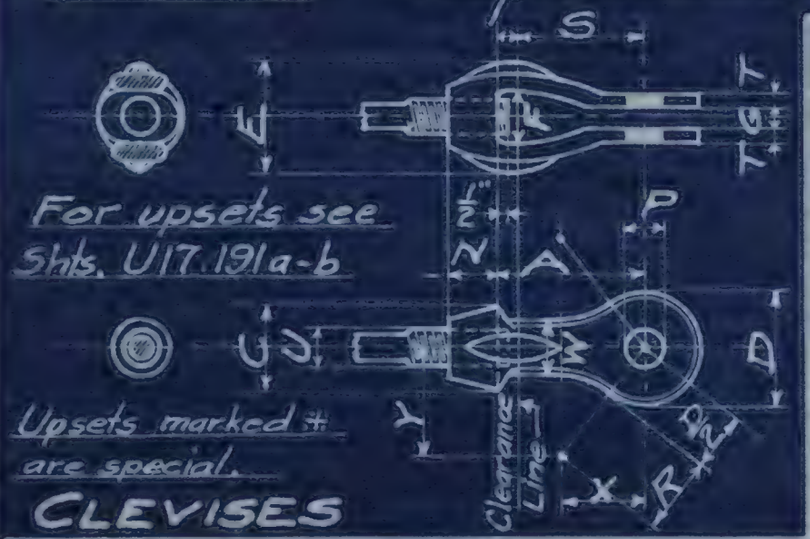
L' = ℄' + 2"

Grip "G" can be made to suit connect's and should equal Thickness of Gusset + 1/4"

Clevises above and to right of heavy zigzag line may be used with forks straight while those below and to left, should have forks closed in until Pin is not overstd.

HOR + VERT. PIN (Finished)

HOR. PIN (Rough or Finished)



For upsets see Shts. U17.191a-b

Upsets marked + are special.

CLEVISES

PINS

Dia. Pin P	Dia. Head H	Cotter C	Cotter d
1 1/4	1 1/2	2	1/4
1 1/2	1 3/4	2 1/2	"
1 3/4	2	2 3/4	"
2	2 3/8	3	3/8
2 1/4	2 5/8	3 1/4	"
2 1/2	2 7/8	3 3/4	"
2 3/4	3 1/8	4	"
3	3 1/2	5	1/2
3 1/4	3 3/4	5	"
3 1/2	4	6	"
3 3/4	4 1/4	6	"

CLEVIS Nº FOR GIVEN ROD + PIN

Rod O	Rod □	Rod Upset	Diameter of Pin 1	1 1/4	1 1/2	1 3/4	2	2 1/4	2 1/2	2 3/4	3	3 1/4	3 1/2
5/8"		7/8	3										
3/4"		1	3	3	3	4	4						
7/8"	3/4"	1 1/8	"	"	"	4	4						
	7/8"	1 1/4		4	4	"	"						
1		1 3/8		"	"	"	"						
1 1/8	1	1 1/2		"	"	"	"	5	5				
1 1/4	1 1/8	1 5/8		"	"	"	"	"	"				
1 3/8		1 3/4			5	5	5	"	"				
1 1/2	1 1/4	1 7/8			"	"	"	"	"				
1 5/8	1 3/8	2			"	"	"	"	"	6	6		
1 3/4		2 1/8			"	"	"	"	"	"	"		
1 7/8	1 1/2	2 1/4					6	6	6	"	"	7	7
2	1 5/8	2 3/8					"	"	"	"	"	"	"
2 1/8	1 3/4	2 1/2					"	"	"	"	"	"	"
2 1/4	1 7/8	2 3/4							7	7	7	"	"
2 3/8	2	2 7/8							"	"	"	"	"

Clevis Nº	Head D	W	T	Max. P	Min. P	R	X	Y	Nut N	C	Max. U	Min. U	E	Fork F	A	S	Clevis Nº
3	3	1 1/2	1/2	1 1/2	1	2 1/4	2 1/4	3	1 1/2	2 1/4	1 1/8	1	3 1/16	1 1/4	5	4	3
4	4	2	"	2	1 1/4	3	3	4	1 3/4	2 7/8	1 5/8	1 1/8	3 5/8	1 3/4	6	5	4
5	5	2 1/2	5/8	2 1/2	1 1/2	3 3/4	3 3/4	5	2 1/4	3 3/4	2 1/8	1 1/2	4 1/2	2 1/4	7	6	5
6	6	3	3/4	3	2	4 1/2	4 1/2	6	2 1/2	4 3/8	2 1/2	2	5 3/8	2 3/4	8	7	6
7	7	3 1/2	7/8	3 1/2	2 1/2	5 1/4	5 1/4	7	3	5	2 7/8	2 1/4	6 3/16	3 1/4	9	8	7

C12.051a

C12.0510a

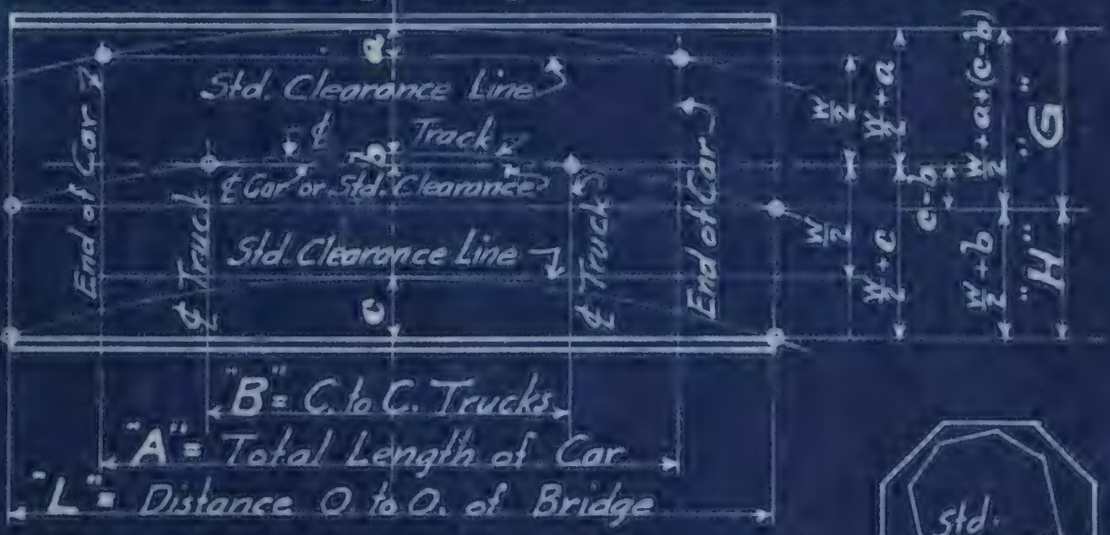
CLEARANCES FOR RAILWAY BRIDGES

STANDARD CLEARANCE DIAGRAM

Clearances for Through Bridges on a Tangent Track.

CLEARANCES ON A CURVE

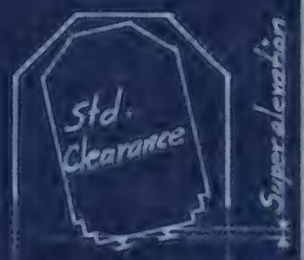
Clearances for Through Bridges on a Curved Track.



"B" = C. to C. Trucks

"A" = Total Length of Car

"L" = Distance C. to C. of Bridge



a = Middle Ordinate for Chord "A"
b = " " " " "B"
c = " " " " "L"

W = Standard Clearance Width.

G = Required outer Clearance = $\frac{W}{2} + a + (c-b)$

H = " inner " = $\frac{W}{2} + b$

"A" = 81'-0" ; "B" = 56'-9" for longest car.

Clear Distance between Trusses for

Through Girder Spans = G + H + superelevation

" Truss " = G + H + (superelevation x 3)

Girder Span	G+H+Superelev.
Truss "	G+H+(Superelev. x 3)

C. R. R. Co's Standard
Cl Approach

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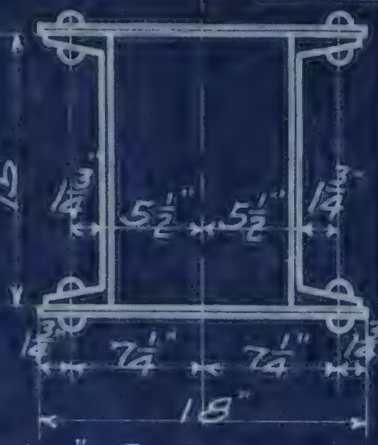
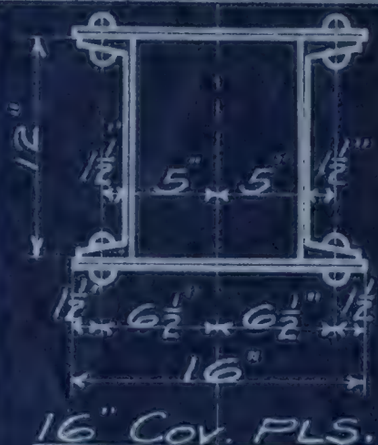
C15.121 a

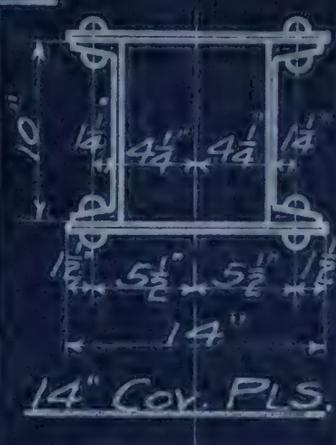
STEEL COLUMNS
STD. DIMENSIONS



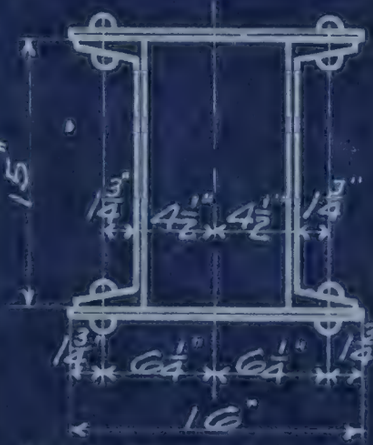
18" Cov. Pls.



16" Cov. Pls.

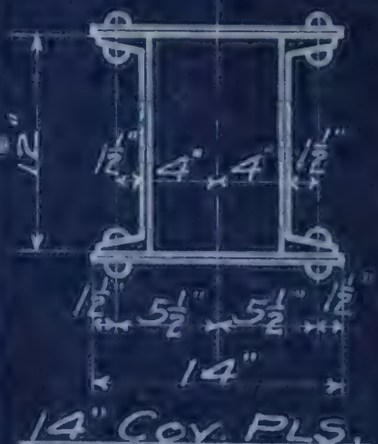


14" Cov. Pls.



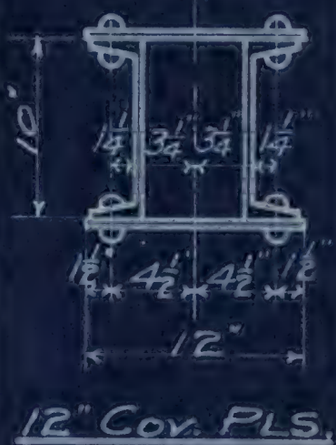
16" Cov. Pls.

15" Chan. Cols.



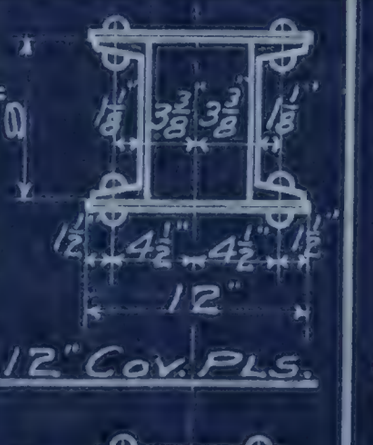
14" Cov. Pls.

12" Chan. Cols.

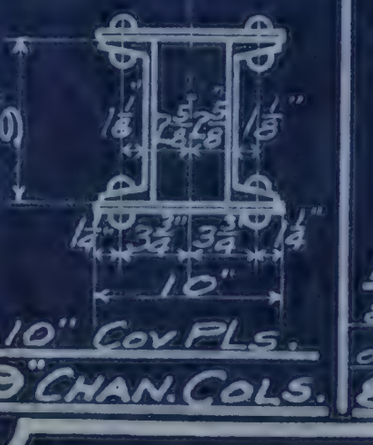


12" Cov. Pls.

10" Chan. Col.

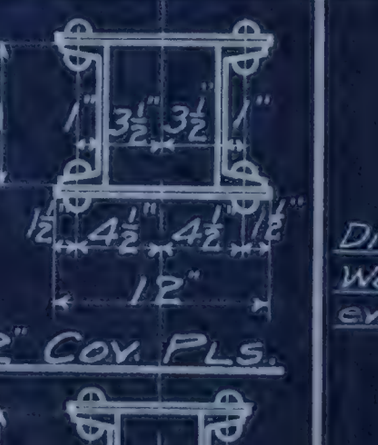


12" Cov. Pls.

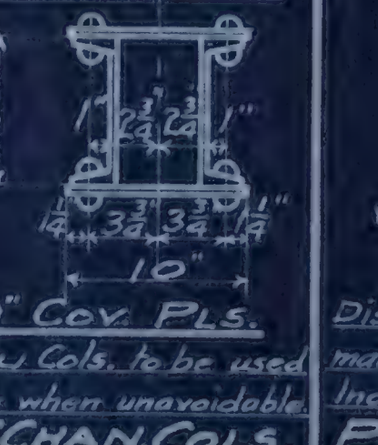


10" Cov Pls.

9" Chan. Cols.



12" Cov. Pls.

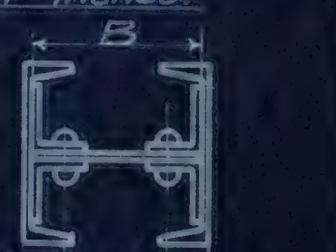


10" Cov. Pls.

8" ⊔ Cols. to be used only when unavoidable.

8" Chan. Cols.

Dist "A" = Web Pl. + ½"
Web Pl. to be always in even Inches.



Dist "B" = Web + (⅜" to ⅝") to make Dist "C" in even Inches or Half Inches.

Pl. + Ang. Cols.

A.R.Co's Standard.
As Approved:- 6-12-07.

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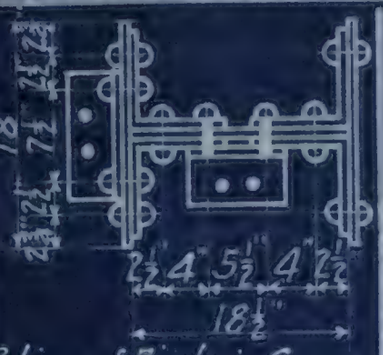
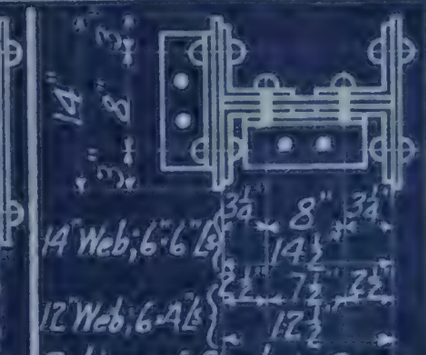
5-2013

Typical Rivet Gaugings for Columns



2 Lines of Rivets in Cover
4 " " " " Web

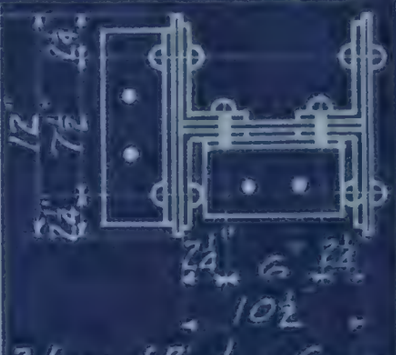
Web 18" Covers 18" Ls 8"·8"



14" Web; 6"·6" Ls
12" Web; 6"·4" Ls

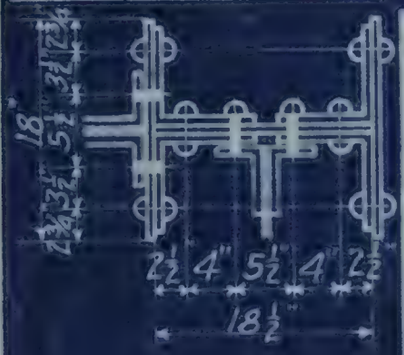
2 Lines of Rivets in Cover
2 " " " " Web

Web {14" / 12"} Covers {14" / 14"} Ls {6"·6" / 6"·4"}

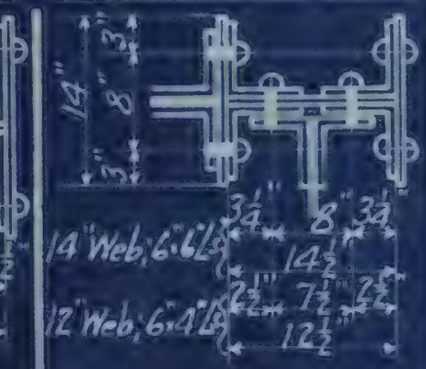


2 Lines of Rivets in Cover
2 " " " " Web

Web 10" Covers 12" Ls 5"·3½"

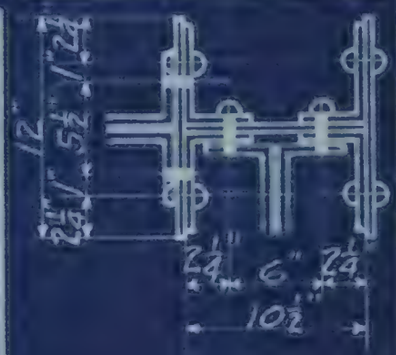


Web 18" Covers 18" Ls 8"·8"



14" Web; 6"·6" Ls
12" Web; 6"·4" Ls

Web {14" / 12"} Covers {14" / 14"} Ls {6"·6" / 6"·4"}



Web 10" Covers 12" Ls 5"·3½"

2 Lines of Rivets in Web of Ls and Reinf Plates.

Web Connections — 15" ⊔ Cols. with Reinforcing Web Plates

2 Lines of Rivets in Web of ⊔ and Reinf Plates.

Web Connections — 15" ⊔ Cols. with Reinforcing Web Plates

2 Lines of Rivets in Web of Ls and Reinf Plates.

Web Connections — 12" ⊔ Cols. with Reinforcing Web Plates

Web Connections — ⊔ Cols. without Reinf. Pls.

NOTE — Where Bms. are connected by Seat Ls, Top Clips are shown.

Cover Connections — For ⊔ Cols. with Covers 16" or over.

Cover Connections — For ⊔ Cols. with Covers under 16"

A.S.C.E. Standard
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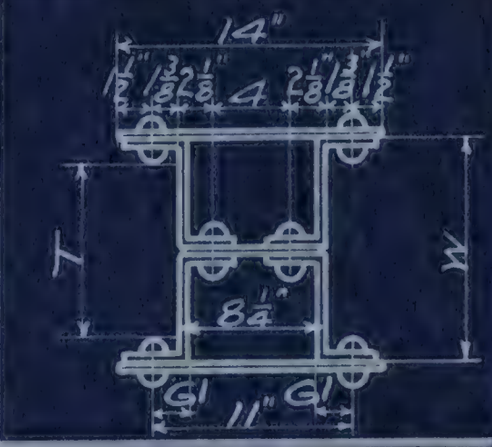
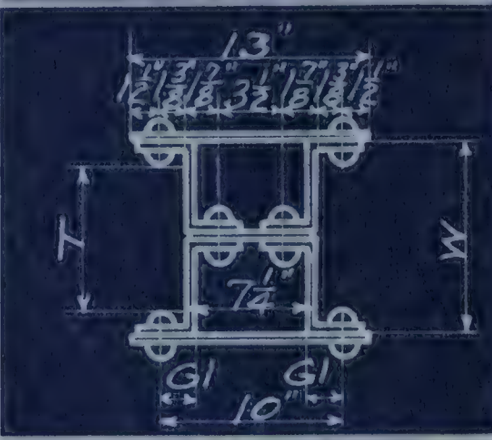
C15.123a

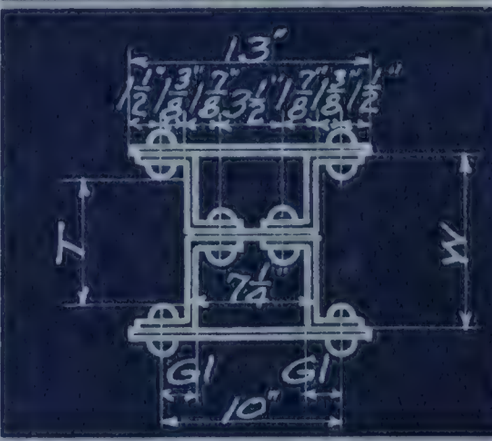
STEEL COLUMNS
"Z" BAR — STD. DIMENSIONS

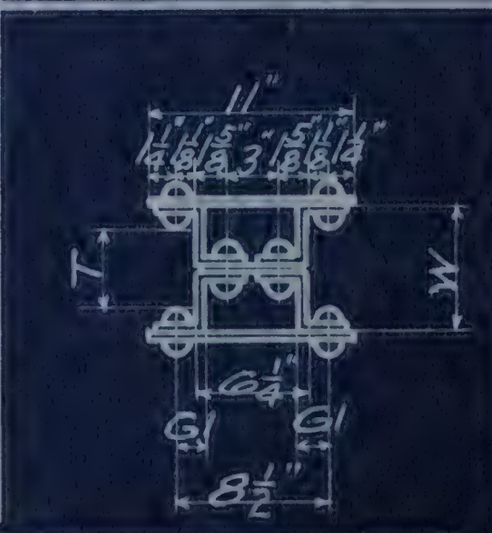
Z Bar Nom. Size	Z Bar Thks	Web Pl. Width	Web Pl. Thks	Width W	Gauge G1	Tang. T	Nom. Size of Col.
6"	3/8	8" x	3/8	12 3/8	1 3/4	11	12
	7/16		7/16	12 9/16	1 13/16	11 1/16	"
	1/2		1/2	12 3/4	1 7/8	11 1/8	"
	9/16		9/16	12 9/16	1 15/16	10 11/16	"
	5/8		5/8	12 3/4	2	10 3/4	"
	11/16		11/16	12 15/16	2 1/16	10 13/16	"
	3/4		3/4	12 3/4	2 1/8	10 3/8	"
	13/16		13/16	12 15/16	2 3/16	10 7/16	"
	7/8		7/8	13 1/8	2 1/4	10 1/2	"
5"	5/16	7" x	5/16	10 5/16	1 11/16	9 1/16	10
	3/8		3/8	10 1/2	1 3/4	9 1/8	"
	7/16		7/16	10 11/16	1 13/16	9 3/16	"
	1/2		1/2	10 1/2	1 7/8	8 3/4	"
	9/16		9/16	10 11/16	1 15/16	8 13/16	"
	5/8		5/8	10 7/8	2	8 7/8	"
	11/16		11/16	10 11/16	2 1/16	8 7/16	"
	3/4		3/4	10 7/8	2 1/8	8 1/2	"
	13/16		13/16	11 1/16	2 3/16	8 13/16	"
4"	1/4	7" x	1/4	8 1/4	1 5/8	7 1/8	8
	5/16		5/16	8 7/16	1 11/16	7 3/16	"
	3/8		3/8	8 5/8	1 3/4	7 1/4	"
	7/16		7/16	8 7/16	1 13/16	6 13/16	"
	1/2		1/2	8 5/8	1 7/8	6 7/8	"
	9/16		9/16	8 13/16	1 15/16	6 15/16	"
	5/8		5/8	8 5/8	2	6 1/2	"
	11/16		11/16	8 13/16	2 1/16	6 9/16	"
	3/4		3/4	9	2 1/8	6 5/8	"
3"	1/4	6" x	1/4	6 1/4	1 3/8	5 3/8	6
	5/16		5/16	6 7/16	1 7/16	5 1/16	"
	3/8		3/8	6 5/8	1 1/2	5 1/2	"
	3/8		3/8	6 3/8	1 1/2	5	"
	7/16		7/16	6 9/16	1 9/16	5 1/16	"
	7/16		7/16	6 7/16	1 9/16	4 13/16	"
	15/32		15/32	6 17/32	1 19/32	4 27/32	"
	1/2		1/2	6 1/2	1 5/8	4 7/8	"
	1/2		1/2	6 5/8	1 5/8	4 7/8	"
	9/16		9/16	6 11/16	1 11/16	4 15/16	"

RIVETS — 3/4" ϕ









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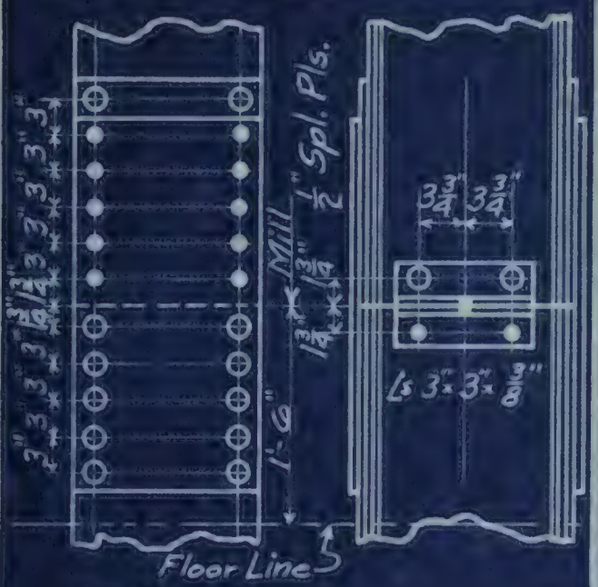
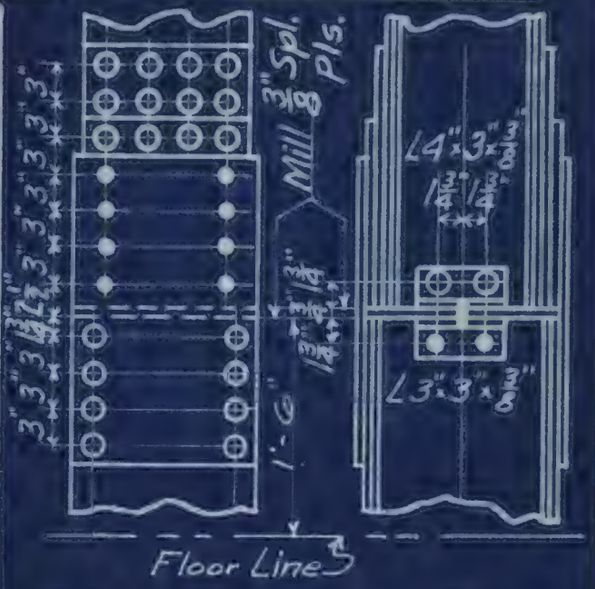
Pat 5-22-10

C15.124 a

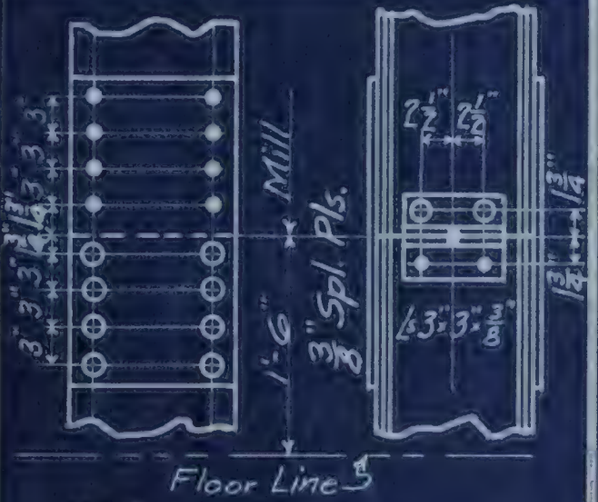
COLUMN SPLICES - CHANNEL



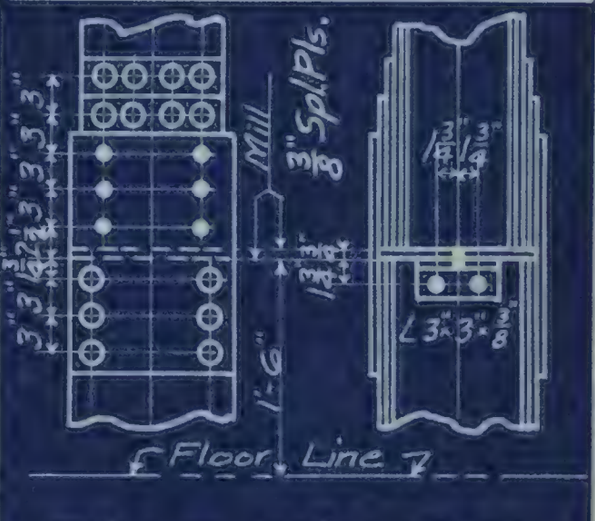
15" ⊔ COL.



15" ⊔ + 12" ⊔ COL.



12" ⊔ COL.



12" ⊔ + 10" ⊔ COL.

10" ⊔ COL.

GENERAL NOTES:-

Cols under 10" have splice similar to 10" Cols.

Clips on webs of ⊔ to be shop or field riveted to suit erection.

It is sometimes preferred to have the fillers vary by 1/8" in thickness, the thinest being 1/8" thick. If the required thickness comes in 16ths, the next smaller eight is taken.

Use no fillers where the required thickness of the filler would be less than 1/4". These Splices are to be used only where Column is supported near splice. All other cases are special.

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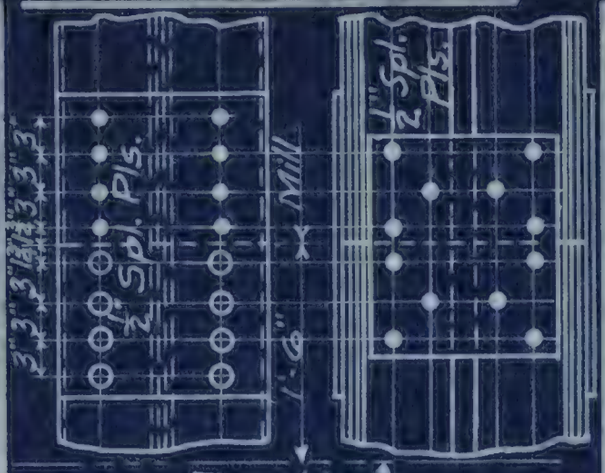
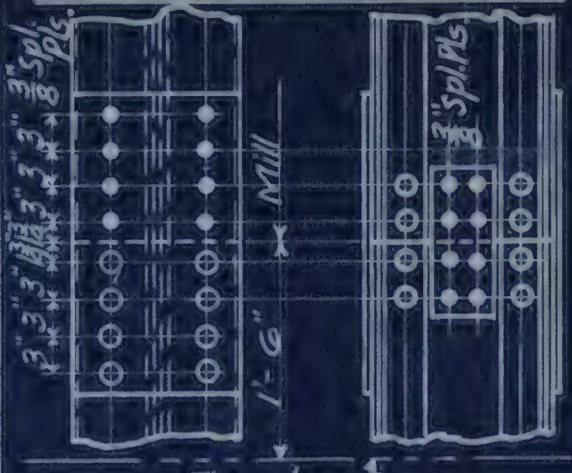
COLUMN SPLICES - PLATE + ANGLE.



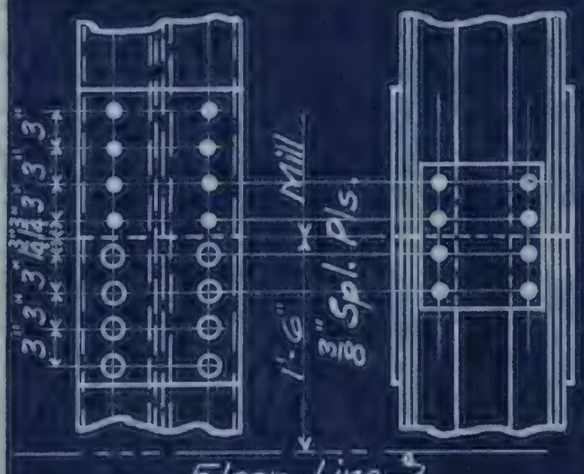
8"·8" Flange Ls; 18" Web; 18" Cor. Pls.

18" H Col.



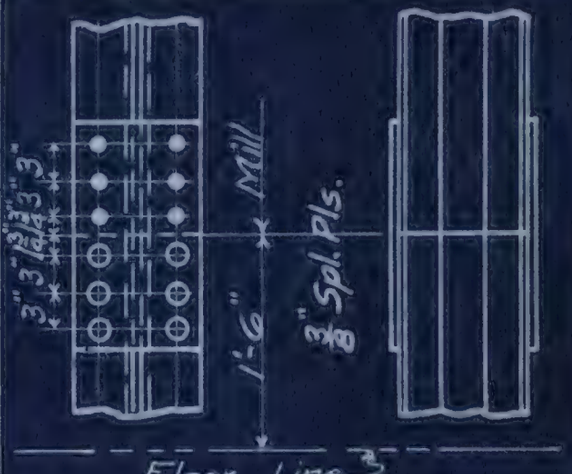
6"·4" Flange Ls; 14" Web; 14" Cor. Pls.

14" H Col.



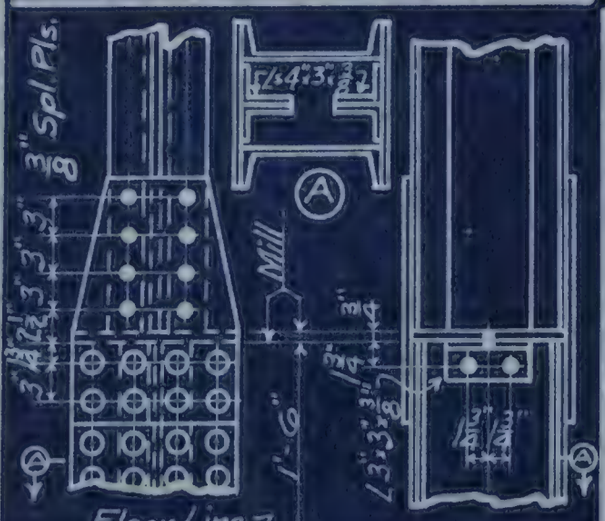
6"·4" Flange Ls; 12" Web; 14" Cor. Pls.

12" H Col.

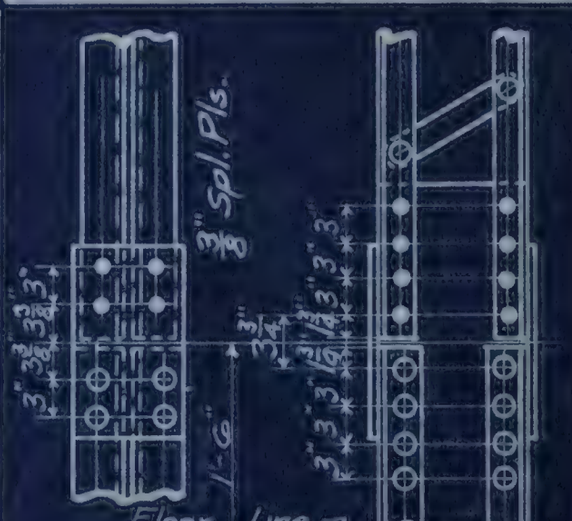


5"·3½" Flange Ls; 10" Web.

10" H Col.



12" ⊔ + 12" H Col.



12" H + 12" Latt. Col.

These splices are to be used only where Column is supported near splice. All other cases are special. For Fillers see C15.124 a. Angles can also be used in the web in place of the splice plate shown.

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COLUMNS IN GENERAL —

General Notes on Beam Seats and Stiffeners.

Use Seat without Stiffeners when beam reaction does not exceed 12000*. Sometimes Stiffeners may be omitted by increasing thickness of Seat Angle.

For Reactions 12000* and under use ½" Angle
15000* ---------- " ½" "
18000* ---------- " ⅝" "

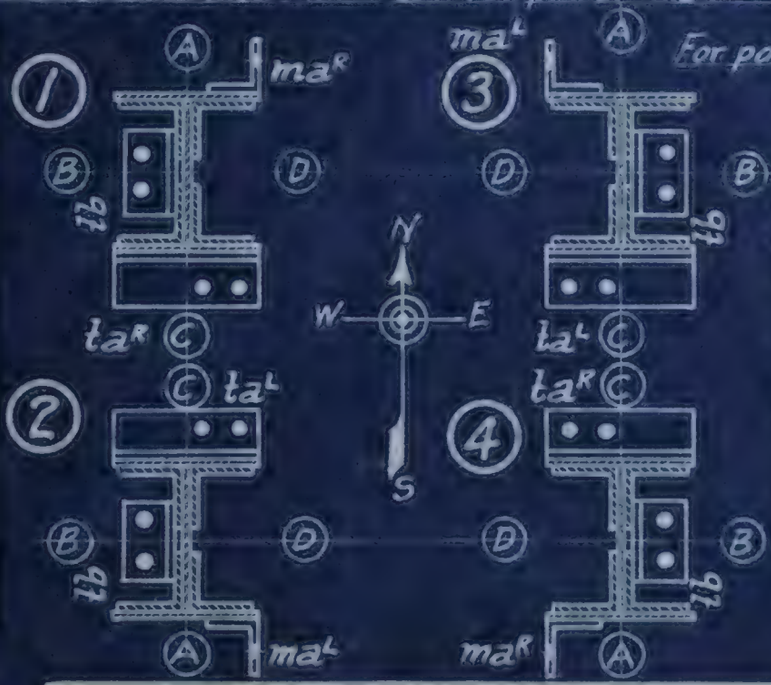
Where Stiffeners are used, figure out-standing leg only for bearing at—
American Bridge Co's Value ---- 24000* per Sq. In.
N.Y. State Public Service " ---- 20000* " " "
N.Y. City Building Code " ---- 16000* " " "

Where possible use single stiffeners under 4 rivets in length and double stiffeners over 5 rivets in length.

② Where Crane Beams rests on brackets, sketch ①, use stiffeners only when load exceeds 16000* or where seat cannot contain a sufficient number of rivets. Use ⅜" Seat Angle for loads under 12000* and ½ Seat Angle for loads 12000* and over.

① Where one stiffener angle is used, as in sketch ②, the required Angle for a given load is obtained by subtracting the value of two rivets (single shear or bearing as the case might be) from the load. Then, with this value in table on sheet C15:127a, find the "k" angle for the required guage.

For Seat and Top Angles the gauges are standard which are as follows =
Legs against col shaft — 1¾"-3" for 6" legs; 1¾ for legs under 6"
Outstanding Legs — 2½"-2¾" " " " ; 2½" " " "
The std. spacing of ends of cols. is 1¾"-3"-3" etc from the Top or the Bottom.
In ⫫ cols make the dist. b.to b. of ℓs ½" greater than width of web plate.
For Drawing Room Convenience, note on drawing which face is "North" or "East". Cover Faces are marked "A" & "C" and Web Faces, "B" & "D" - lettered counter clock wise. When cols. are paired the face marks do not change.



For paired cols., note common face.
For Cols. paired as
*1+2, call Face "D" - East
*1+3, " " "A" - North
*3+4, " " "B" - East
*2+4, " " "C" - North
For Cols. alike as
*1+4 — call Face {A - North for *1 / C - " " *4}
*2+3 — call Face {C - North for *2 / A - " " *3}
Specify paired Cols. on Drawings as follows —
Col. *1 (0-2) Right
Col. *2 (0-2) Left

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BEAM SEATS FOR COLUMNS - MATERIAL

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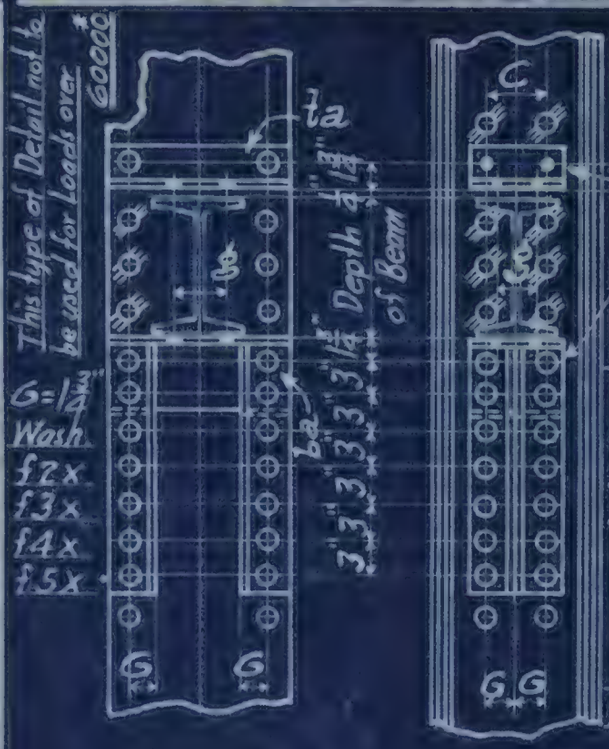

Top Clips to be Riveted or Bolted and Rivets flattened to ⅜" to suit Erection Conditions.

Top Ls - t1x to t67x

Bottom Ls - b1x to b67x

"G" = 1¾"	"G" = 2¼"	"G" = 2½"	
k3x k_1^R f1x	k13x k_1^R f11x	k23x k_1^R f21x	
k4x k_1^R d2x	k14x k_1^R d12x	k24x k_1^R d22x	
k5x k_1^R d3x	k15x k_1^R d13x	k25x k_1^R d23x	
k6x k_1^R d4x	k16x k_1^R d14x	k26x k_1^R d24x	
k7x k_1^R d5x	k17x k_1^R d15x	k27x k_1^R d25x	Etc, etc.

Where ⅞" Rivets are used, the letter "a" is to be added to Mark. Thus - f2ax, d2ax.

FILLERS

	G=1¾" or C=3½"		G=2¼" or C=5"		G=2½" or G=5½"		G=2¾" or C=7½"		G=3¾" or C=8"	
	Mark	Size	Mark	Size	Mark	Size	Mark	Size	Mark	Size
Single	Washer	½" thick	Washer	½" thick	Washer	½" thick	Washer	½" thick	Washer	½" thick
	f2x	3"-½"-6"	f12x	3½"-½"-6"	f22x	4"-½"-6"	f32x	4"-½"-6"	f42x	5"-½"-6"
	f3x	" - 9"	f13x	" - 9"	f23x	" - 9"	f33x	" - 9"	f43x	" - 9"
	f4x	" - 1'-0"	f14x	" - 1'-0"	f24x	" - 1'-0"	f34x	" - 1'-0"	f44x	" - 1'-0"
	f5x	" - 1'-3"	f15x	" - 1'-3"	f25x	" - 1'-3"	f35x	" - 1'-3"	f45x	" - 1'-3"
Double	d2x	6"-½"-6"	d12x	7½"-½"-6"	d22x	8"-½"-6"	d32x	10"-½"-6"	d42x	10½"-½"-6"
	d3x	" - 9"	d13x	" - 9"	d23x	" - 9"	d33x	" - 9"	d43x	" - 9"
	d4x	" - 1'-0"	d14x	" - 1'-0"	d24x	" - 1'-0"	d34x	" - 1'-0"	d44x	" - 1'-0"
	d5x	" - 1'-3"	d15x	" - 1'-3"	d25x	" - 1'-3"	d35x	" - 1'-3"	d45x	" - 1'-3"

TOP AND BOTTOM CLIPS

Top Ls = 4"×3"×⅜" - Mark below to be preceeded by "t/b"
Bottom Ls = 6"×4"×½" - " " " " " " "

G	Values of "C" 3½"		5"		5½"		7½"		8"		9"		11"	
	Mark	Lgth	Mark	Lgth	Mark	Lgth	Mark	Lgth	Mark	Lgth	Mark	Lgth	Mark	Lgth
4"	1x	7"	11x	7½	21x	8"	31x	10"	41x	10½	51x	11½	61x	1'-1½
3¾	2x	"	12x	"	22x	"	32x	"	42x	"	52x	"	62x	"
3½	3x	6½	13x	"	23x	"	33x	"	43x	"	53x	"	63x	"
3	4x	6	14x	"	24x	"	34x	"	44x	"	54x	"	64x	"
2¾	5x	"	15x	"	25x	"	35x	"	45x	"	55x	"	65x	"
2½	6x	"	16x	"	26x	"	36x	"	46x	"	56x	"	66x	"
2¼	7x	"	17x	"	27x	"	37x	"	47x	"	57x	"	67x	"

A.R.C.A. Standard
As Approved

- A.B.Co's Standard -

As Approved:- 6-1-11.

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BEAM SEAT STIFFENERS FOR COLS. - MAX. LOAD

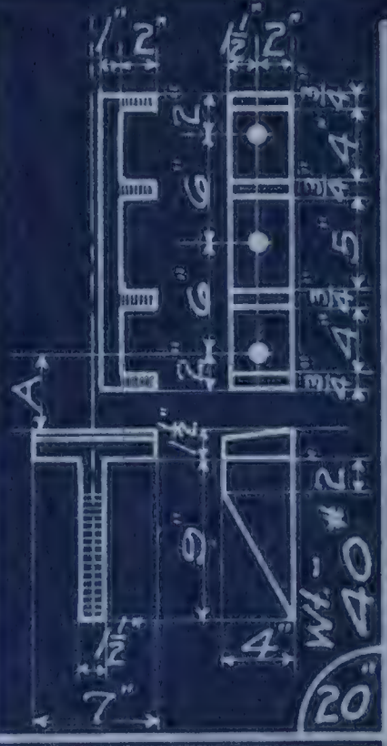
Stiffeners with 7/8"ϕ Rivets to be marked with a thus k3ax etc. Loads given in thousands of lbs

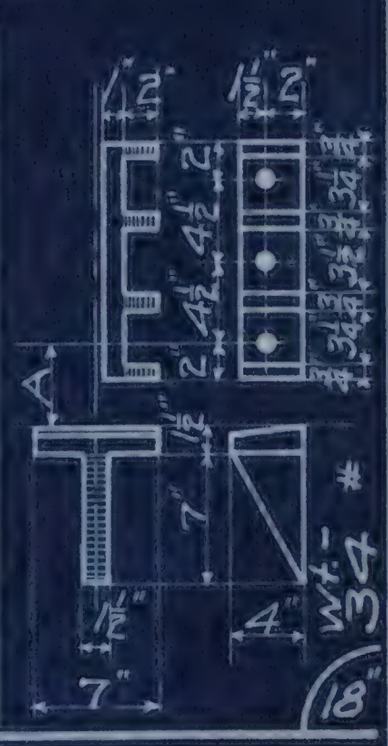
Mark k	Gauge G	3/4"ϕ RIVETS Stiffener Angle	Ft	Lgth Ins	3/4"ϕ RIVETS LOAD 1-Stiffener S.=12000 B.=24000 Single Shear	Brg. 1/4"	1-Stiffener S.=10000 B.=20000 Single Shear	Brg. 1/4"	2-Stiffeners b. to b. S.=10000 B.=20000 Single Shear	Brg. 1/4"	2-Stiffeners b. to b. S.=12000 B.=24000 Single Shear	Brg. 1/4"	7/8"ϕ RIVETS Stiffener Angle	Ft	Lgth Ins	7/8"ϕ RIVETS LOAD 1-Stiffener S.=12000 B.=24000 Single Shear	Brg. 5/16"	1-Stiffener S.=10000 B.=20000 Single Shear	Brg. 5/16"	2-Stiffeners b. to b. S.=10000 B.=20000 Single Shear	Brg. 5/16"	2-Stiffeners b. to b. S.=12000 B.=24000 Single Shear	Brg. 5/16"
3 x	1 3/4"	3 x 3 x 3/8		8 3/4	11.9	10.1	9.9	8.3	26.4	22.4	31.8	27.0	3 x 3 x 3/8		8 3/4	16.1	14.6	13.4	12.3	36.0	32.8	43.3	39.3
4 x	"	" x " x "		11 3/4	17.9	14.8	14.4	12.1	35.2	30.0	42.4	36.0	" x " x "		11 3/4	22.7	21.3	19.7	18.0	48.0	43.6	57.7	52.5
5 x	"	" x " x "	1	2 3/4	22.8	19.4	19.0	15.9	44.0	37.4	53.0	45.0	3 1/2 x 3 x 3/8	1	2 3/4	31.0	28.0	25.9	23.7	60.0	54.6	72.2	65.6
6 x	"	3 1/2 x 3 x 3/8	1	5 3/4	28.4	24.1	23.5	19.8	52.8	44.8	63.6	54.0	3 1/2 x 3 x 1/2	1	5 3/4	38.5	34.8	32.1	29.4	72.0	65.6	86.6	78.7
7 x	"	3 1/2 x 3 x 1/2	1	8 3/4	33.9	28.8	28.1	23.6	61.6	52.4	74.2	63.0	" x " x "	1	8 3/4	46.0	41.5	38.3	35.1	84.0	76.4	101.1	91.8
8 x	"	" x " x "	1	11 3/4	39.4	33.4	32.7	27.5	70.4	59.8	84.8	72.0		1	11 3/4	53.5	48.3	44.6	40.9	96.0	87.4	115.5	104.9
13 x	2 1/4	3 1/2 x 3 x 3/8		8 3/4	10.4	8.9	8.7	7.3	26.4	22.4	31.8	27.0	3 1/2 x 3 x 3/8		8 3/4	14.2	12.8	11.8	10.8	36.0	32.8	43.3	39.3
14 x	"	" x " x "		11 3/4	15.7	13.4	13.1	11.0	35.2	30.0	42.4	36.0	" x " x "		11 3/4	21.4	19.3	17.8	16.3	48.0	43.6	57.7	52.5
16 x	"	" x " x "	1	2 3/4	21.1	18.0	17.6	14.8	44.0	37.4	53.0	45.0	3 1/2 x 3 1/2 x 3/8	1	2 3/4	28.7	25.9	23.9	21.9	60.0	54.6	72.2	65.6
16 x	"	3 1/2 x 3 1/2 x 3/8	1	5 3/4	26.6	22.6	22.1	18.6	52.8	44.8	63.6	54.0	3 1/2 x 3 1/2 x 1/2	1	5 3/4	36.1	32.6	30.1	27.6	72.0	65.6	86.6	78.7
17 x	"	3 1/2 x 3 1/2 x 1/2	1	8 3/4	32.2	27.4	26.8	22.5	61.6	52.4	74.2	63.0	" x " x "	1	8 3/4	43.8	39.5	36.5	33.4	84.0	76.4	101.1	91.8
18 x	"	" x " x "	1	11 3/4	37.7	32.0	31.3	26.3	70.4	59.8	84.8	72.0	3 1/2 x 3 1/2 x 5/8	1	11 3/4	51.3	46.3	42.7	39.2	96.0	87.4	115.5	104.9
23 x	2 1/2	4 x 3 x 3/8		8 3/4	9.9	8.4	8.2	6.9	26.4	22.4	31.8	27.0	4 x 3 x 3/8		8 3/4	13.4	12.1	11.2	10.2	36.0	32.8	43.3	39.3
24 x	"	" x " x "		11 3/4	15.0	12.7	12.5	10.5	35.2	30.0	42.4	36.0	" x " x "		11 3/4	20.4	18.4	17.0	15.6	48.0	43.6	57.7	52.5
25 x	"	" x " x "	1	2 3/4	20.3	17.2	16.9	14.2	44.0	37.4	53.0	45.0	4 x 3 1/2 x 3/8	1	2 3/4	27.6	24.9	23.0	21.1	60.0	54.6	72.2	65.6
26 x	"	4 x 3 1/2 x 3/8	1	5 3/4	25.7	21.8	21.3	17.9	52.8	44.8	63.6	54.0	4 x 3 1/2 x 1/2	1	5 3/4	34.9	31.5	29.1	26.7	72.0	65.6	86.6	78.7
27 x	"	4 x 3 1/2 x 1/2	1	8 3/4	31.4	26.6	26.0	21.9	61.6	52.4	74.2	63.0	" x " x "	1	8 3/4	42.6	38.5	35.5	32.6	84.0	76.4	101.1	91.8
28 x	"	" x " x "	1	11 3/4	36.9	31.4	30.7	25.8	70.4	59.8	84.8	72.0	4 x 3 1/2 x 5/8	1	11 3/4	50.2	45.3	41.8	38.3	96.0	87.4	115.5	104.9
33 x	2 3/4	4 x 3 x 3/8		8 3/4	9.3	7.9	7.7	6.5	26.4	22.4	31.8	27.0	4 x 3 x 3/8		8 3/4	12.6	11.4	10.5	9.6	36.0	32.8	43.3	39.3
34 x	"	" x " x "		11 3/4	14.3	12.1	11.8	10.0	35.2	30.0	42.4	36.0	" x " x "		11 3/4	19.4	17.5	16.1	14.8	48.0	43.6	57.7	52.5
35 x	"	" x " x "	1	2 3/4	19.5	16.7	16.2	13.6	44.0	37.4	53.0	45.0	4 x 3 1/2 x 3/8	1	2 3/4	26.5	23.9	22.1	20.2	60.0	54.6	72.2	65.6
36 x	"	4 x 3 1/2 x 3/8	1	5 3/4	24.9	21.1	20.6	17.4	52.8	44.8	63.6	54.0	4 x 3 1/2 x 1/2	1	5 3/4	33.8	30.5	28.1	25.8	72.0	65.6	86.6	78.7
37 x	"	4 x 3 1/2 x 1/2	1	8 3/4	30.5	25.9	25.3	21.2	61.6	52.4	74.2	63.0	" x " x "	1	8 3/4	41.5	37.4	34.6	31.7	84.0	76.4	101.1	91.8
38 x	"	" x " x "	1	11 3/4	36.1	30.6	30.0	25.2	70.4	59.8	84.8	72.0	4 x 3 1/2 x 5/8	1	11 3/4	49.0	44.3	40.9	37.5	96.0	87.4	115.5	104.9
43 x	3 3/4	5 x 3 x 3/8		8 3/4	7.4	6.3	6.2	5.2	26.4	22.4	31.8	27.0	5 x 3 x 3/8		8 3/4	10.1	9.1	8.4	7.7	36.0	32.8	43.3	39.3
44 x	"	" x " x "		11 3/4	11.7	9.9	9.7	8.2	35.2	30.0	42.4	36.0	" x " x "		11 3/4	15.9	14.4	13.3	12.2	48.0	43.6	57.7	52.5
45 x	"	" x " x "	1	2 3/4	16.7	14.2	13.9	11.7	44.0	37.4	53.0	45.0	5 x 3 1/2 x 3/8	1	2 3/4	22.8	20.5	19.0	17.4	60.0	54.6	72.2	65.6
46 x	"	5 x 3 1/2 x 3/8	1	5 3/4	21.9	18.5	18.1	15.2	52.8	44.8	63.6	54.0	5 x 3 1/2 x 1/2	1	5 3/4	29.7	26.8	24.7	22.7	72.0	65.6	86.6	78.7
47 x	"	5 x 3 1/2 x 1/2	1	8 3/4	27.4	23.3	22.7	19.1	61.6	52.4	74.2	63.0	" x " x "	1	8 3/4	37.2	33.6	31.0	28.4	84.0	76.4	101.1	91.8
48 x	"	" x " x "	1	11 3/4	32.9	27.9	27.3	22.9	70.4	59.8	84.8	72.0	5 x 3 1/2 x 5/8	1	11 3/4	44.6	40.3	37.2	34.1	96.0	87.4	115.5	104.9

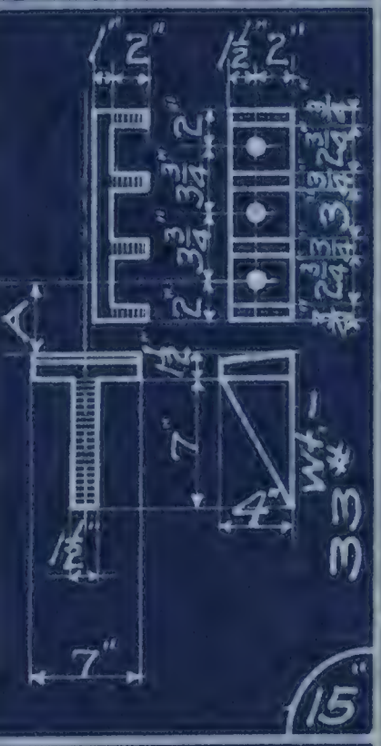
C15.127 a

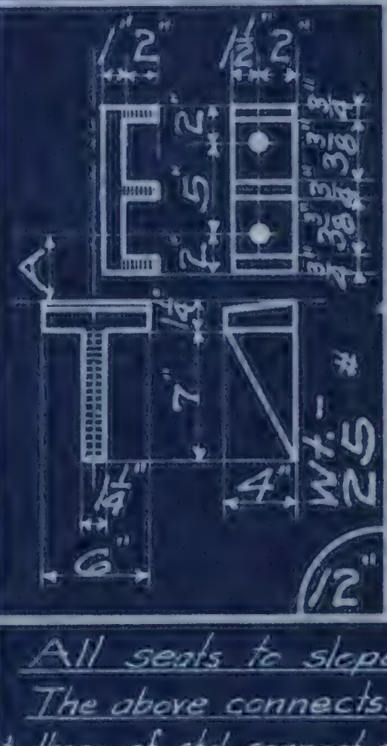
C15.1210a

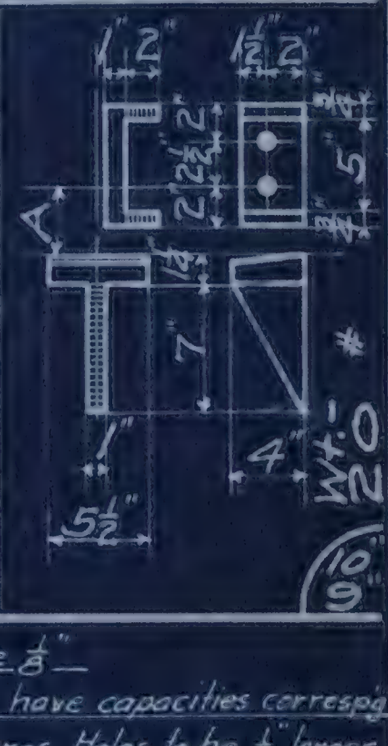
CAST IRON COLUMNS — BEAM CONNECTIONS

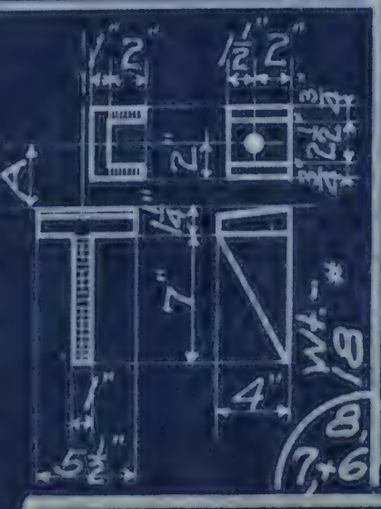












All seats to slope ⅛"

The above connects. have capacities corresp'g to those of std. connect. angs. Holes to be ⅛" larger than corresp'g rivet holes in beam. Dist. "A" will vary to fit position of holes when beams are adapted to multiple punch. Otherwise the dist. "A" will be for 24"-4½"; 20"-4"; 18"-4½"; 15"-3¾"; 12"-3½"; 10"-3¾"; 9"-3¼"; 8"-4"; 7"-3½"; 6"-3".

The dist. from top of col. to beam seat must be suff't to allow a clearance of ½" betⁿ top of beam and underside of flange or bolt head.

A.R.Co's Standard
As Approved:- 10-8-'10.

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JAA 5-61a

- A.B.Co's Standard -

As Approved;- 2-11-07.

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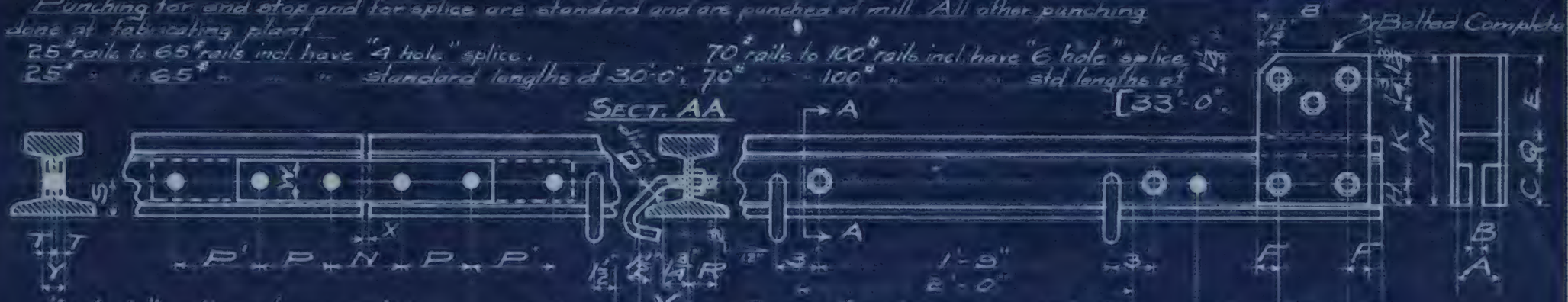
CRANE STOP - HOOK BOLT - RAIL SPLICE

Punching for end stop and for splice are standard and are punched at mill. All other punching done at fabricating plant.

25# rails to 65# rails incl. have "4 hole" splice.
25# " " 65# " " " standard lengths of 30'-0".

70# rails to 100# rails incl. have "6 hole" splice.
70# " " 100# " " " std lengths of [33'-0".



"4 hole" splice shown solid. ← 6" — 25# to 35# incl. 14 spcs @ 2'-0" — 6" — 4" — 2"

"6 hole" " " dotted. ← 4½" — 40# to 65# " 14 " " 2'-0" — 4½" — 5" — 2½"

4½" — 70# to 100# " 15 " " 2'-0" — 4½" — 6" — 5" — 2½"

Rail Sect.	CRANE STOP A	B	C	Q	E	F	M	H	K	Std. Mill Holes	Diam. of Bolts	SPLICE PLATES W	T	N	P	P'	Y	X	HOOK BOLT S	R	D	Y
100#	2 3/4	3/4	3	1 3/4	6 1/4	1 1/2	11	1 1/2	6	1	3/4	3	1/2	5 1/8	5	6	1 3/4	1/8	2 1/2	2	7/8	Width of flange of beam
95#	2 11/16	13/16	"	1 11/16	6 5/16	"	11	"	"	1	"	"	"	"	"	"	"	"	2 11/16	"	"	
90#	2 5/8	3/4	2 3/4	1 3/4	5 15/16	"	10	1 3/8	5 1/8	1	"	2 3/4	"	"	"	"	"	"	2 11/32	"	"	
85#	2 9/16	13/16	"	1 9/16	5 11/16	"	"	"	"	1	"	"	"	"	"	"	"	"	2 1/4	"	"	
80#	2 1/2	3/4	2 1/2	"	5 5/16	"	"	1 1/4	5 1/4	1	"	2 1/2	"	"	"	"	"	"	2 1/16	"	"	
75#	2 1/2	3/4	"	1 1/2	6	"	"	"	"	1	"	"	"	"	"	"	"	"	2 1/8	"	"	
70#	2 7/16	11/16	"	1 3/8	6 1/8	"	"	"	"	1	"	"	"	"	"	6	"	"	2 1/16	"	"	
65#	2 7/16	11/16	2 1/4	"	5 3/8	"	9	1 1/8	4 3/8	1	"	2 1/4	3/8	"	"	—	1 3/8	"	1 31/32	"	"	
60#	2 3/8	5/8	"	1 1/4	5 1/2	"	"	"	"	1	"	"	"	"	"	—	"	"	1 29/32	"	"	
55#	2 1/4	5/8	2	"	5 3/4	"	"	1	4 1/2	1	5/8	2	"	"	"	—	"	"	1 13/16	"	3/4	
50	2 1/8	5/8	"	1 3/16	5 3/16	"	"	"	"	1	"	"	"	"	"	—	"	"	1 25/32	1 3/4	"	
45	2	5/8	"	1 1/16	5 5/16	"	"	"	"	7/8	"	"	"	"	"	—	"	"	1 23/32	"	"	
40#	1 7/8	1/2	1 3/4	1 1/8	6 1/8	"	"	7/8	4 5/8	7/8	"	1 3/4	1/4	"	"	—	1	"	1 9/16	"	"	
36#	1 3/4	3/8	1 1/2	1 1/16	5 7/16	2	8	3/4	3 3/4	3/4	"	1 1/2	"	4 1/8	4	—	7/8	"	1 7/16	1 5/8	5/8	
30#	1 5/8	3/8	"	1	5 1/2	"	"	"	"	3/4	"	"	"	"	"	—	7/8	"	1 11/32	"	"	
25#	1 1/2	3/8	"	3/4	5 3/4	"	"	"	"	5/8	1/2	"	"	"	"	—	1	"	1 7/32	"	"	

C18.011 a

A.B.Co's Standard

As Approved;- 5-13-09

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CRANE RAIL SPLICE & HOOK BOLT

Punching for Splices is Standard and is done at Mill. All other work is done at Plant.

HOOK BOLT

No.	Dia Bolt	A	B	C	Ligth	Wt. Incl. Nut
1	7/8	2 3/4	2 1/4	1 7/8	8 5/8	1.76
2	"	2 1/4	2 3/8	1 3/4	8 3/8	1.71
3	3/4	2 3/8	2 1/2	1 11/16	8 1/2	1.25
4	"	2	2 1/8	1 5/8	7 7/8	1.18
5	5/8	2 1/4	2	1 3/16	7 1/2	.77
6	"	1 3/4	2 1/8	1 1/16	7 1/8	.74

RAIL SPLICE

Rail Sect.	Std Mill Hole	Gauge G	Sol. Bolts Dia	Sol. Bolts Ligth	SPLICE BARS W	T	N	P	P'	Y	E	Length	Wt. of two Bars with Bolts
100A	1	2 1/2	3/4	2 3/4	2 1/2	1/2	5 1/8	5	6	1 3/4	1 9/16	2'-6 1/4	25.0
90	1	2 3/8	"	"	"	"	"	"	"	"	"	"	25.0
85	1	2 1/4	"	"	"	"	"	"	"	"	"	"	25.0
80	1	2 3/16	"	"	"	"	"	"	"	"	"	"	25.0
75	1	2 1/8	"	"	"	"	"	"	"	"	"	"	25.0
70	1	2 1/16	"	2 1/4	2 1/4	5/16	"	"	"	1 1/4	"	"	15.5
65	1	2	"	"	"	"	"	"	"	"	"	1'-6 1/4	9.6
60	1	1 15/16	"	"	"	"	"	"	"	"	"	"	9.6
55	1	1 13/16	5/8	2	2	"	"	"	"	"	1 5/16	1'-5 3/4	7.6
50	1	1 3/4	"	"	"	"	"	"	"	"	"	"	7.6
45	7/8	1 5/8	"	1 3/4	1 3/4	1/4	"	"	"	1	"	"	5.8
40	7/8	1 9/16	"	"	"	"	"	"	"	"	"	"	5.8
35	3/4	1 1/2	1/2	"	1 1/2	"	4 1/8	4	"	3/8	1 1/16	1'-2 1/4	3.9
30	3/4	1 3/8	"	"	"	"	"	"	"	"	"	"	3.9
25	3/4	1 1/4	"	"	1 1/4	"	"	"	"	1	"	"	3.3

Rail Gauge S	Hook Bolts to use 12" I 31# to 40	15" I 42# to 55	15" I 60# to 75	18" I 55# to 70	20" I 65# to 75	20" I 80# to 100	24" I 80# to 100
1 7/8			2	2	2	1	1
"			"	"	"	"	"
"			"	"	"	"	"
"			"	"	"	"	"
1 3/4		4	4	4	3	3	3
"		"	"	"	"	"	"
"		"	"	"	"	"	"
"		"	"	"	"	"	"
1 5/16	6	6	5	5			
"	"	"	"	"			
"	"	"	"	"			

C18.012.3

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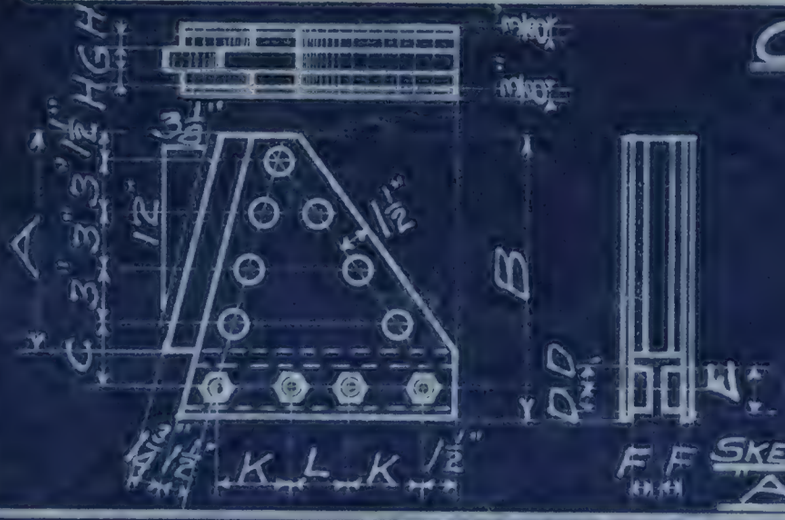
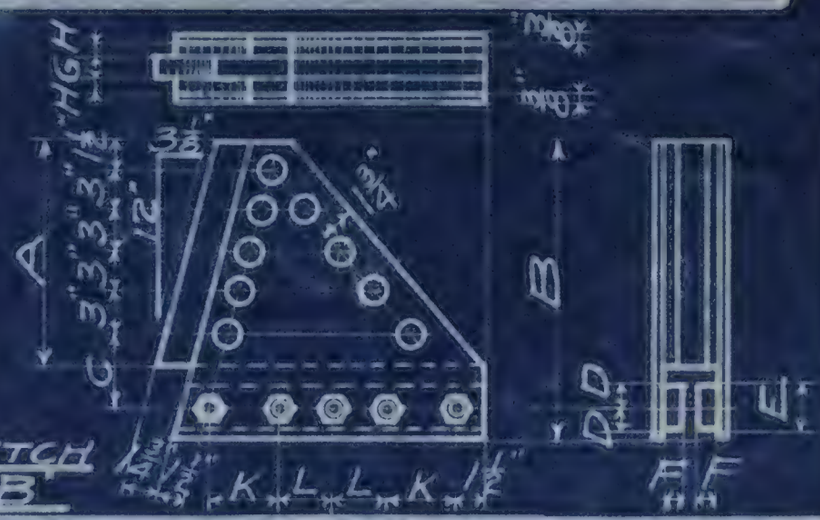
CRANE STOPS



SKETCH A



SKETCH B

RAIL			BOLTS		CRANE STOPS											
Sect. No.	Mill Hole	Gauge	Dia.	Length		A	B	C	D	E	F	G	H	K	L	Wt.
100 A	1	2 1/2	3/4	4 1/2	Sketch "B"	15	19 1/2	4 3/4	1 1/4	2 1/2	1	1 3/4	1/2	5	3	210
95 "	1	2 7/16	"	"		"	"	"	"	"	5/16	"	"	"	"	209
90 "	1	2 3/8	"	4 1/4		"	"	"	"	"	"	"	"	"	"	"
85 "	1	2 1/4	"	"		"	"	"	"	"	7/8	"	"	"	"	207
80 "	1	2 3/16	"	"		"	"	"	"	"	"	"	3/8	"	"	196
75 "	1	2 1/8	"	"		"	"	"	"	"	"	"	"	"	"	"
70 "	1	2 1/16	"	"		"	"	"	1 1/8	2 1/4	"	"	"	"	"	195
65 "	1	2	"	4	Sketch "A"	12	15 3/4	4	"	"	"	1 1/4	3/16	"	"	132
60 "	1	1 15/16	"	"		"	"	"	"	"	"	"	"	"	"	"
55 "	1	1 13/16	5/8	3 3/4		"	"	"	1	2	13/16	"	"	"	"	129
50 "	1	1 3/4	"	"		"	"	"	"	"	3/4	"	7/16	"	"	120
45 "	7/8	1 5/8	"	3 1/2		"	15 1/2	"	7/8	1 3/4	"	"	"	"	"	117
40 "	7/8	1 9/16	"	"		"	"	"	"	"	1 1/16	"	"	"	"	116
35 "	3/4	1 1/2	"	3 1/4		"	15	3 1/2	3/4	1 1/2	"	1	3/8	4	"	91
30 "	3/4	1 3/8	"	"		"	"	"	"	"	5/8	"	"	"	"	90
25 "	5/8	1 1/4	1/2	3		"	14 3/4	"	5/8	1 1/4	9/16	"	1/4	"	"	81

C18.013a

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As Approved;- 5-12-09.

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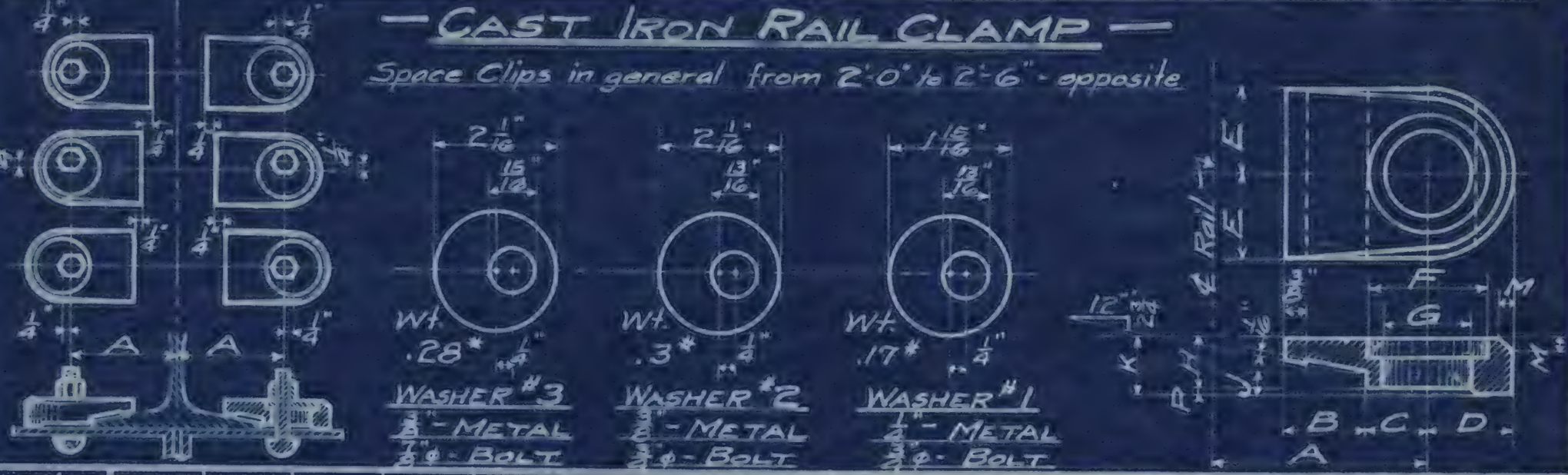
— CAST IRON RAIL CLAMP —

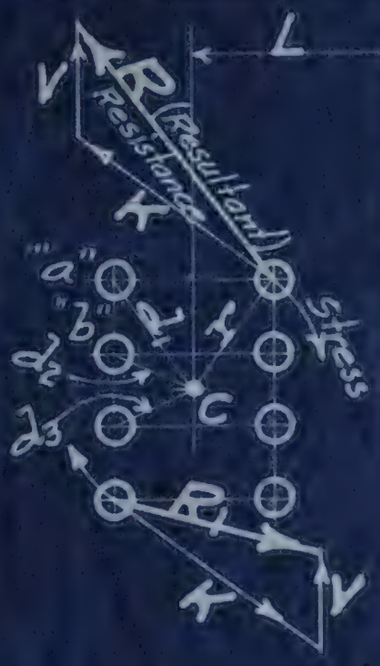
Space Clips in general from 2'-0" to 2'-6" - opposite



Rail Sect.	A	B	C	D	E	F	G	H	J	K	M	N	P	Patt. No.	Wt. of Clamp	Mark of Washer
100A	3¾	1½	1	1½	1½	2¼	1½	1	⅜	1⅛	¼	⅜	⅛	A21	1.5	W2+W3
95	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
90	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
85	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
80	"	1¼	1⅜	"	"	"	"	⅞	"	1	"	"	"	A22	1.8	"
75	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
70	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
65	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
60	"	1⅛	1¾	"	"	"	"	¾	5/16	⅞	"	"	"	A23	1.75	"
55	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
50	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
45	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
40	2¾	⅞	1⅛	1¼	1¼	2⅛	1⅜	11/16	¼	¾	⅛	¼	1/16	A24	1.00	W1
35	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
30	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
25	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"

C18.014 a

Rivets for Eccentric Conns.



Let C = Center of Resistance of any group of rivets

n = Number of rivets in group

M_x = External Moment due to load "W" distant "L" from C = WL

M_1 = Internal Moment of Resistance of rivets

k = Resistance of one rivet unit distance from "C"

Since Resistance varies as its distance from the center, the Resistance of rivet "a" = kd_1; of "b" = kd_2; etc.

The Internal Resisting Moment of rivet "a" = $(kd_1)d_1$; of "b" = $(kd_2)d_2$; etc.

$\therefore M_1 = kd_1^2 + kd_2^2 + \text{etc.}$; and for equilibrium

$M_1 = M_x = k(d_1^2 + d_2^2 + \text{etc.})$ or if $Q = d_1^2 + d_2^2 + \text{etc.}$

$M_x = kQ$ or $k = \frac{M_x}{Q}$

Since the rivet farthest from the center is strained the most, the Extreme Rivet of the Group governs. This "Critical" Rivet is generally on the same side of "C" as the Load.

Let r = distance of Extreme Rivet to Center of Resistance.

$\therefore$ Resistance of Extreme Rivet = $K = kr$ and acts in a direction at right angles to its Lever Arm from the Center

$$\therefore K = \frac{M_x r}{Q}$$ in which

K = Resistance of Extreme Rivet of Group.

M_x = WL = External Moment of load "W" distant "L" from Center of Resistance of Group of Rivets.

r = Distance of Extreme Rivet from C.R. of Rivets.

$Q = d_1^2 + d_2^2 + \text{etc.}$ = Sum of the Squares of the dist. of each Rivet from the C. of R.

Also $V = \frac{W}{n}$ acting in a direction // to W

in which W = Load ; n = No. of Rivets.

The Resultant "R" of K and V is the total stress on the Extreme Rivet.

Let $P = \frac{Q}{r}$ = Polar Section Modulus. $\therefore K = \frac{M_x}{P}$

For Values of "P" see Sheet E3.032 a

C.R.C.'s Standard. Is Approved:- 8-5-14.

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VALUES OF "P" FOR GROUPS OF RIVETS

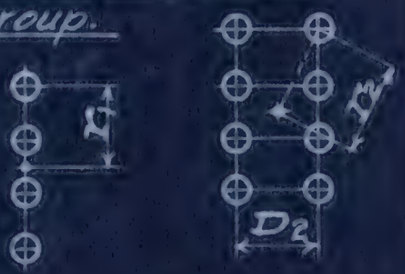
"P" = Polar Section Modulus = $\frac{\text{Polar Mom. of Inertia of Rivs}}{r}$

in which "r" = Dist. of Extreme Rivet to the C. R. of the Group. See Sheet E3.031a. Each Rivet is assumed to be Unit Area.

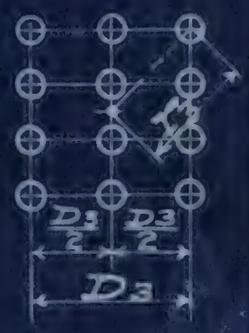
Vertical Spacing = 3"

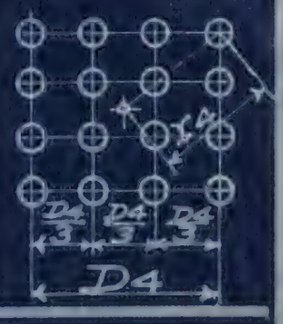
No = Total number of rivets in the group.

1-LINE		2-LINES					
			Distance D_2				
No		No	3	6	9	12	15
1	0	2	3	6	9	12	15
2	3	4	8	13	19	24	30
3	6	6	14	21	29	37	46
4	10	8	22	30	39	50	61
5	15	10	32	40	50	64	77
6	21	12	44	52	63	77	93
7	28	14	58	66	77	93	110
8	36	16	75	82	94	110	128
9	45	18	93	100	113	129	148
10	55	20	113	120	132	149	170
11	66	22	135	142	154	172	192
12	78	24	159	166	178	196	216



3-LINES					4-LINES				
	Distance D_3					Distance D_4			
No.	6	8	10	12	No	9	12	15	18
3	6	8	10	12	4	10	13	16	20
6	14	18	21	25	8	22	28	35	41
9	25	30	35	40	12	38	46	55	64
12	38	43	49	56	16	56	66	77	89
15	53	59	66	74	20	77	89	102	116
18	72	77	86	94	24	102	116	130	146
21	93	99	107	116	28	131	145	160	178
24	117	123	131	141	32	163	178	194	213
27	144	150	159	168	36	199	215	232	252
30	174	180	189	199	40	240	256	273	294
33	207	214	222	233	44	284	300	318	339
36	243	250	258	268	48	332	348	365	390





SAFE ECCENTRIC LOADS IN THOS. OF LBS FOR ONE LINE OF RIVETS

	Dist. of Load to Line of Rivets									
No.	0	1½	3	6	9	12	15	18	21	24
1	4.4	0	0	0	0	0	0	0	0	0
2	8.8	6.2	3.9	2.1	1.4	1.1	0.9	0.7	0.6	0.5
3	13	10	7.3	4.1	2.8	2.1	1.7	1.4	1.2	1.1
4	17	15	11	6.7	4.7	3.6	2.9	2.4	2.1	1.8
5	22	19	15	9.8	6.9	5.3	4.3	3.6	3.1	2.7
6	26	24	20	13	9.5	7.4	6.0	5.0	4.3	3.8
7	30	28	24	17	12	9.8	7.9	6.7	5.8	5.1
8	35	33	29	21	15	12	10	8.5	7.4	6.4
9	39	37	33	25	19	15	12	10	9.2	8.1
10	44	42	38	29	22	18	15	12	11	9.8
11	48	46	43	34	26	21	18	15	13	11
12	52	51	47	38	30	25	20	18	15	13

No. = Total number of rivets in the group.

Vertical Spacing of Rivets = 3"

Max. Stress in end rivets = 4400#

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A.R. Co's Standard
As Approved 8-5-10.

E3.033 a

SAFE ECCENTRIC LOADS IN THOS. OF LBS FOR GROUPS OF RIVETS

"L" = Dist. of Load to Center of Group of Riv.
Vertical Spacing of Rivets = 3"
Max. Stress in extreme rivet = 4400#

L	No. Lines A	No. Rivets in "2 Line" Group												No. Lines B	No. Rivs in "3 Line" G.					
		2	4	6	8	10	12	14	16	18	20	22	24		3	6	9	12	15	18
24"	3	0.5	1.4	2.5	3.9	5.8	8.0	10	13	16	20	23	27	6	1.0	2.5	4.3	6.5	9.1	12
	6	1.0	2.1	3.5	5.0	6.8	9.2	11	13	16	20	23	27	8	1.3	3.0	4.9	7.2	9.9	13
	9	1.4	2.9	4.5	6.3	8.1	10	12	15	18	21	25	28	10	1.6	3.4	5.6	8.0	10	14
	12	1.7	3.6	5.5	7.5	9.7	11	14	17	20	23	27	30	12	1.9	3.9	6.2	8.9	11	15
	15	2.1	4.2	6.5	8.8	11	13	16	19	22	25	29	33							
21"	3	0.6	1.6	2.9	4.4	6.6	9.1	11	14	18	22	26	31	6	1.1	2.8	4.9	7.2	10	14
	6	1.1	2.4	3.9	5.6	7.6	10	12	15	18	23	26	31	8	1.5	3.3	5.5	8.1	11	14
	9	1.5	3.3	5.0	7.0	9.1	11	14	17	20	24	28	32	10	1.8	3.9	6.3	9.0	12	15
	12	1.9	4.0	6.2	8.3	10	13	16	19	22	26	30	34	12	2.1	4.4	7.0	10	13	16
	15	2.3	4.7	7.2	9.7	12	15	18	21	24	28	32	36							
18"	3	0.7	1.9	3.3	5.1	7.6	10	13	17	21	25	30	35	6	1.3	3.2	5.6	8.4	11	16
	6	1.2	2.8	4.5	6.5	8.8	11	14	18	21	26	30	35	8	1.7	3.8	6.3	9.3	12	17
	9	1.7	3.7	5.7	8.0	10	13	16	19	23	27	32	36	10	2.0	4.4	7.2	10	13	18
	12	2.2	4.5	6.8	9.4	12	15	18	21	25	29	34	38	12	2.4	5.0	7.9	11	14	19
	15	2.6	5.3	8.1	10	14	17	20	23	27	31	36	40							
15"	3	0.8	2.2	3.9	6.0	9.0	12	15	20	24	29	35	41	6	1.5	3.7	6.6	10	14	18
	6	1.4	3.2	5.3	7.6	10	13	17	21	25	30	35	41	8	2.0	4.5	7.4	11	15	19
	9	2.0	4.3	6.6	9.2	12	15	18	23	27	31	37	42	10	2.4	5.2	8.4	12	16	20
	12	2.5	5.2	7.9	10	14	17	20	25	29	33	39	44	12	2.8	5.9	9.4	13	17	22
	15	2.9	5.9	9.1	12	16	19	23	27	31	36	41	46							
12"	3	1.0	2.7	4.8	7.4	11	15	19	24	30	36	42	49	6	1.9	4.5	7.9	12	16	22
	6	1.7	3.9	6.3	9.1	12	16	20	25	30	36	42	49	8	2.4	5.4	8.9	13	17	23
	9	2.4	5.0	7.9	10	14	18	22	27	32	37	43	50	10	2.8	6.1	9.9	14	19	24
	12	2.9	6.0	9.2	12	16	20	24	29	34	39	45	51	12	3.3	6.9	11	15	20	26
	15	3.4	6.9	10	14	18	22	26	31	36	42	47	53							
9"	3	1.2	3.5	6.2	9.6	14	19	24	30	37	44	52	60	6	2.4	5.8	10	15	21	28
	6	2.2	4.8	8.0	11	15	20	25	31	37	44	51	59	8	3.1	6.7	11	16	22	29
	9	2.9	6.1	9.3	13	17	22	27	32	39	45	52	59	10	3.5	7.6	12	17	23	30
	12	3.5	7.2	10	15	19	24	29	35	41	47	53	60	12	4.0	8.5	13	19	25	32
	15	4.0	8.1	12	16	21	26	31	37	43	49	56	62							
6"	3	1.7	4.9	8.6	13	19	25	32	39	48	57	65	75	6	3.3	7.8	13	20	28	37
	6	2.9	6.5	10	15	20	26	33	40	48	56	64	73	8	4.0	9.0	14	21	29	38
	9	3.7	7.8	12	17	22	28	34	41	49	56	64	73	10	4.7	10	16	23	30	39
	12	4.4	9.1	14	19	24	30	36	42	50	57	65	73	12	5.3	11	17	24	32	40
	15	4.9	9.9	15	20	26	32	38	44	51	59	66	74							
3"	3	2.9	7.9	13	20	29	38	46	56	65	74	83	93	6	5.7	12	20	30	41	53
	6	4.4	9.5	15	22	29	37	45	54	63	72	80	89	8	6.2	13	21	31	42	53
	9	5.2	10	16	23	30	38	46	54	63	72	80	89	10	6.9	14	23	32	43	54
	12	5.8	11	18	24	31	39	46	55	63	72	80	89	12	7.5	15	24	33	44	55
	15	6.3	12	19	25	32	40	47	56	63	72	81	89							
1½"	3	4.4	11	19	27	37	46	55	64	73	82	92	101	6	7.5	16	28	39	52	66
	6	5.8	12	19	27	36	49	53	61	71	80	88	97	8	8.4	17	28	40	52	66
	9	6.6	13	20	28	36	44	53	61	71	80	86	97	10	9.1	18	29	40	53	66
	12	7.1	14	21	29	37	44	54	62	71	80	88	97	12	9.6	19	30	41	53	66
	15	7.3	14	22	29	37	45	54	62	71	80	88	97							
0	3G 12 15	8.8	17	26	35	44	52	61	70	79	88	96	105	3G	9.7	13	26	39	52	66	79

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A. F. B. Co's Standard
As Approved 8-5-10.

E3.033b

SAFE ECCENTRIC LOADS IN THOS. OF LBS FOR GROUPS OF RIVETS

"L" = Dist. of Load to Center of Group
Vertical Spacing of Rivets = 3"
Max. Stress in extreme rivet = 4400#

L	m. Line B	No. Rivs in "3 Line" G.						m. Line C	No. Rivets in "4 Line" Group												
		21	24	27	30	33	36		4	8	12	16	20	24	28	32	36	40	44	48
24"	6	15	19	24	29	35	40	9	1.7	3.7	6.2	9.4	13	17	21	27	33	40	48	55
	8	16	20	25	30	35	41	12	2.0	4.6	7.4	10	14	18	23	29	35	41	49	56
	10	17	21	26	31	36	42	15	2.6	5.4	8.5	12	16	20	25	30	36	43	50	57
	12	18	22	27	32	37	42	18	3.0	6.2	9.7	13	17	22	27	32	38	45	52	59
21"	6	17	22	27	33	39	46	9	1.9	4.2	7.0	10	14	19	24	30	37	44	51	61
	8	18	23	28	34	39	46	12	2.4	5.2	8.3	12	16	20	26	32	39	46	53	63
	10	19	24	29	35	40	47	15	2.9	6.1	9.6	13	17	22	28	34	41	48	55	64
	12	20	25	30	36	41	48	18	3.4	7.0	10	15	19	24	30	36	43	50	57	66
18"	6	20	25	31	38	45	52	9	2.1	4.8	8.0	12	16	22	28	34	42	51	60	69
	8	21	26	32	38	45	53	12	2.7	5.9	9.1	13	18	24	30	36	44	52	61	71
	10	22	27	33	39	46	54	15	3.3	6.9	10	15	20	25	32	38	46	54	62	72
	12	23	28	34	40	47	54	18	3.8	7.9	12	17	22	27	34	40	48	56	64	74
15"	6	24	30	36	44	52	60	9	2.5	5.6	9.4	14	19	25	32	40	49	59	69	80
	8	25	31	37	45	52	61	12	3.2	6.9	11	15	21	27	34	42	51	60	70	81
	10	26	32	38	46	53	62	15	3.8	8.0	12	17	23	29	36	44	53	62	71	83
	12	27	33	39	47	54	62	18	4.4	9.0	14	19	27	31	39	46	57	64	73	85
12"	6	29	36	44	53	62	72	9	3.0	6.7	11	17	23	31	39	48	58	70	82	94
	8	30	37	44	53	62	72	12	3.8	8.2	13	19	25	33	41	50	60	71	83	95
	10	31	38	45	54	63	72	15	4.5	9.4	14	21	27	35	43	52	62	73	84	96
	12	32	39	46	55	64	73	18	5.2	10	16	23	29	37	45	54	65	75	86	98
9"	6	36	45	55	65	76	87	9	3.8	8.5	14	21	29	38	48	60	70	86	100	114
	8	37	45	55	65	76	87	12	4.7	10	16	23	31	40	50	62	73	86	100	114
	10	38	46	56	65	76	87	15	5.5	11	18	25	33	42	52	63	75	87	101	115
	12	39	47	56	66	77	87	18	6.3	12	20	27	35	44	55	65	77	88	102	116
6"	6	47	58	69	82	94	107	9	5.2	11	18	28	38	50	63	77	92	108	124	140
	8	48	58	69	82	94	107	12	6.3	13	21	30	40	52	65	78	93	108	124	140
	10	49	59	70	82	94	107	15	7.2	15	23	32	42	54	66	79	94	109	124	140
	12	50	60	71	83	95	107	18	8.0	16	25	34	45	56	68	80	95	110	125	141
3"	6	66	79	92	106	119	133	9	8.0	17	28	41	55	71	87	104	122	139	156	174
	8	66	79	92	106	119	133	12	9.2	19	30	43	57	72	87	104	122	139	156	174
	10	67	79	92	106	119	133	15	10	21	32	45	58	73	88	105	122	139	156	174
	12	67	79	92	106	119	133	18	11	22	34	46	60	74	89	105	122	139	156	174
1½"	6	79	92	106	119	132	146	9	11	23	37	52	69	86	104	122	139	157	175	193
	8	79	92	106	119	132	146	12	12	25	38	54	70	86	104	122	139	157	175	193
	10	79	92	106	119	132	146	15	13	26	40	55	71	87	104	122	139	157	175	193
	12	79	92	106	119	132	146	18	13	27	43	56	72	88	105	122	139	157	175	193
0"	6 8 10 12	92	105	118	132	145	158	9 12 15 18	17	35	52	70	88	105	123	140	158	176	193	211

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A.R.Co's Standard
As Approved 5-5-12

10-29-10

E 25.051 a

EYE BARS (ORDINARY)

Bars marked # should be used only when absolutely unavoidable

BAR			HEAD				
Width Ins.	Thickness Max Ins.	Thickness Min Ins.	Diam. D Ins.	Max Pin Diam Ins.	Max Pin Excess Hd. over Bar %	Add'l Material "A" Order'g Bar Ft. - Ins.	Add'l Material "A" Calcul'g Wt. Ft. - Ins.
2	1	1/2	4 1/2	1 3/4	37.5	1 - 0	0 - 7
			5 1/2	2 3/4		1 - 4	0 - 11
			# 6 1/2	3 3/4		1 - 9	1 - 4
2 1/2	1	5/8	6	2 1/2	40.0	1 - 3	0 - 10
			7	3 1/2		1 - 7	1 - 2
			# 8	4 1/2		2 - 0	1 - 7
3	1 1/2	5/8	7 1/2	3 1/4	41.7	1 - 6	1 - 1
			8 1/2	4 1/4		1 - 11	1 - 5
			# 9 1/2	5 1/4		2 - 4	1 - 10
4	1 3/4	3/4	10	4 1/2	37.5	1 - 11	1 - 6
		7/8	11	5 1/2		2 - 3	1 - 10
		1	# 12	6 1/2		2 - 8	2 - 2
5	2	3/4	12	5 1/4	35.0	2 - 1	1 - 8
		1	13 1/2	6 3/4		2 - 8	2 - 2
		1	# 15	8 1/4		3 - 3	2 - 9
6	2	3/4	14	5 3/4	37.5	2 - 4	1 - 10
		1	14 3/4	6 1/2		2 - 6	2 - 1
		1	# 16 1/2	8 1/4		3 - 2	2 - 8
7	2	1	16 1/2	7	35.7	2 - 7	2 - 2
		1 1/8	17 1/2	8		2 - 11	2 - 6
		1 1/8	# 18 1/2	9		3 - 4	2 - 11
8	2	1	18	7	37.5	2 - 8	2 - 3
		1 1/8	19	8		3 - 0	2 - 6
		1 1/4	# 20	9		3 - 4	2 - 11
9	2	1 1/8	20	7 1/2	38.9	2 - 11	2 - 6
		1 1/4	# 22	9 1/2		3 - 7	3 - 1
10	2	1 1/8	22 1/2	9	35.0	3 - 5	2 - 10
		1 1/4	24	10 1/2		3 - 9	3 - 3
		1 3/8	# 25	11 1/2		4 - 1	3 - 7
12	2	1 1/4	26 1/2	10	37.5	3 - 8	3 - 3
		1 3/8	28	11 1/2		4 - 2	3 - 8
		1 1/2	# 29 1/2	13		4 - 8	4 - 1
14	2	1 3/8	31	12	35.7	4 - 3	3 - 9
		1 1/2	33	14		4 - 10	4 - 4
		1 5/8	# 34	15		5 - 5	4 - 8
16	2	1 3/4	36	14	37.5	4 - 11	4 - 5
		1 7/8	# 37 1/2	16	34.4	5 - 5	4 - 10

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A.B.Co's Standard.
As Approved,- 8-5-09.

J.A.A. 1-16-10

E25.051b

EYE BARS (ADJUSTABLE)

Bars marked # should be used only when absolutely unavoidable.

Min. Length of short end from C. of Pin to end of screw - 6'-6" preferably - 7'-0"
Thread on short end to be left hand.

BAR		SCREW END				
					Add'l Material "B"	
Width Ins.	Min. thickness Ins.	Diam U Ins.	Excess of Rt. of thd over Bar %	Length M Ins.	Order'g Bar Ft.- Ins	Calcul'g Wt. Ft. - Ins.
2	# 5/8	1 3/4	47.8	4	1-0	0-8
	3/4	1 7/8	44.0	4 1/2	1-0	0-7 1/2
	7/8	2	42.8	4 1/2	0-11	0-7 1/2
2 1/2	# 3/4	2 1/8	52.6	4 1/2	1-0	0-8
	7/8	2 1/4	48.4	5	1-0	0-8
	1	2 3/8	46.4	5	1-0	0-7 1/2
3	# 3/4	2 1/4	44.4	5	1-0	0-7 1/2
	7/8	2 1/4	41.7	5	0-10	0-7
	1	2 1/2	36.5	5 1/2	1-1	0-8 1/2
4	# 3/4	2 1/2	36.5	5 1/2	1-1	0-8 1/2
	7/8	2 3/4	44.0	5 1/2	0-11	0-7 1/2
	1	3	52.1	6	1-1	0-8 1/2
	1 1/8	3 1/4	60.6	6 1/2	1-2	0-9 1/2
5	# 3/4	2 7/8	48.0	6	1-0	0-8
	7/8	3	39.1	6	0-11	0-7
	1	3 1/4	44.5	6 1/2	1-0	0-8
	1 1/8	3 1/2	50.5	7	1-1	0-8 1/2
	1 1/4	3 3/4	56.9	7	1-2	0-9
6	# 1	3 1/2	41.1	7	1-0	0-7 1/2
	1 1/8	3 3/4	45.3	7	1-0	0-8
	1 1/4	4	50.0	7 1/2	1-1	0-8 1/2
	1 3/8	4 1/4	54.9	8	1-2	0-9 1/2
7	# 1 1/8	4	42.8	7 1/2	1-0	0-8
	1 1/4	4 1/4	46.1	8	1-1	0-8 1/2
	1 3/8	4 1/2	49.8	8 1/2	1-2	0-9
	1 1/2	4 3/4	53.8	8 1/2	1-2	0-9 1/2
8	# 1 1/8	4 1/4	42.0	8	1-0	0-8
	1 1/4	4 1/2	44.1	8 1/2	1-1	0-8 1/2
	1 3/8	4 3/4	46.8	8 1/2	1-1	0-8 1/2
	1 1/2	5	49.8	9	1-2	0-9
	1 5/8	5 1/4	53.1	9 1/2	1-3	0-10

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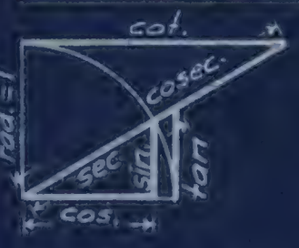
As Approved,- 8-5-'09.

FORMULAE — TRIGONOMETRY



$\sin^2 x + \cos^2 x = 1$; $\tan x = \frac{\sin x}{\cos x}$;

$\cot x = \frac{1}{\tan x} = \frac{\cos x}{\sin x}$; $\sec x = \frac{1}{\cos x}$; $\operatorname{cosec} x = \frac{1}{\sin x}$

$\sec^2 x = 1 + \tan^2 x$; $\operatorname{cosec}^2 x = 1 + \cot^2 x$;

$\operatorname{vers} x = 1 - \cos x$; $\operatorname{covers} x = 1 - \sin x$; $\operatorname{suvers} x = 1 + \cos x$

$\sin x = \sqrt{\frac{1}{2}(1 - \cos 2x)}$; $\cos x = \sqrt{\frac{1}{2}(1 + \cos 2x)}$;

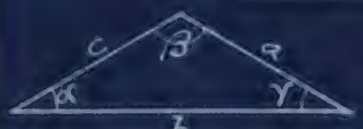
$\tan x = \frac{\sin 2x}{1 + \cos 2x} = \frac{1 - \cos 2x}{\sin 2x}$; $\sin 2x = 2 \sin x \cos x$;

$\cos 2x = 1 - 2\sin^2 x = 2\cos^2 x - 1 = \cos^2 x - \sin^2 x$; $\tan 2x = \frac{2\tan x}{1 - \tan^2 x}$;

$\sin(x+y) = \sin x \cos y + \cos x \sin y$; $\cos(x+y) = \cos x \cos y - \sin x \sin y$;

$\sin(x-y) = \sin x \cos y - \cos x \sin y$; $\cos(x-y) = \cos x \cos y + \sin x \sin y$;

$\tan(x+y) = \frac{\tan x + \tan y}{1 - \tan x \tan y}$; $\tan(x-y) = \frac{\tan x - \tan y}{1 + \tan x \tan y}$



$$\frac{a}{\sin\alpha} = \frac{b}{\sin\beta} = \frac{c}{\sin\gamma}$$

$$c = a\cos\beta + b\cos\alpha$$

$$c^2 = a^2 + b^2 - 2ab\cos\gamma$$

Given One Side and Two Angles — a, α, β,

$\gamma = 180° - (\alpha + \beta)$; $b = \frac{a}{\sin\alpha}\sin\beta$; $c = \frac{a}{\sin\alpha}\sin\gamma$

Given the Three Sides — a, b, c,

$\cos\alpha = \frac{b^2 + c^2 - a^2}{2bc}$; $s = \frac{1}{2}(a+b+c)$; $r = \sqrt{\frac{(s-a)(s-b)(s-c)}{s}}$

$\sin^2\frac{1}{2}\alpha = \frac{(s-b)(s-c)}{bc}$; $\cos^2\frac{1}{2}\alpha = \frac{s(s-a)}{bc}$; $\tan^2\frac{1}{2}\alpha = \frac{(s-b)(s-c)}{s(s-a)}$; $\tan\frac{1}{2}\alpha = \frac{r}{s-a}$

$\sin^2\frac{1}{2}\beta = \frac{(s-a)(s-c)}{ac}$; $\cos^2\frac{1}{2}\beta = \frac{s(s-b)}{ac}$; $\tan^2\frac{1}{2}\beta = \frac{(s-a)(s-c)}{s(s-b)}$; $\tan\frac{1}{2}\beta = \frac{r}{s-b}$

$\sin^2\frac{1}{2}\gamma = \frac{(s-a)(s-b)}{ab}$; $\cos^2\frac{1}{2}\gamma = \frac{s(s-c)}{ab}$; $\tan^2\frac{1}{2}\gamma = \frac{(s-a)(s-b)}{s(s-c)}$; $\tan\frac{1}{2}\gamma = \frac{r}{s-c}$

$$\text{Area} = \sqrt{s(s-a)(s-b)(s-c)}$$

Given Two Sides and Included Angle — b, c, α,

$\frac{b+c}{b-c} = \frac{\tan\frac{1}{2}(\beta+\gamma)}{\tan\frac{1}{2}(\beta-\gamma)}$; $a = \frac{b-c}{\cos x}$ where $\tan x = \frac{2\sin\frac{1}{2}\alpha}{b-c}\sqrt{bc}$

$\left.\begin{aligned}\beta &= \tfrac{1}{2}(\beta+\gamma) + \tfrac{1}{2}(\beta-\gamma)\\ \gamma &= \tfrac{1}{2}(\beta+\gamma) - \tfrac{1}{2}(\beta-\gamma)\end{aligned}\right\}$ in which $\left\{\begin{aligned}\tan\tfrac{1}{2}(\beta-\gamma) &= \frac{b-c}{b+c}\cot\tfrac{1}{2}\alpha\\ \tfrac{1}{2}(\beta+\gamma) &= 90° - \tfrac{1}{2}\alpha\end{aligned}\right.$

$a = \frac{b\sin\alpha}{\sin\beta} = \frac{c\sin\alpha}{\sin\gamma}$ If "c" > "b" use (c−b) and (γ−β)

$$\text{Area} = \tfrac{1}{2}bc\sin\alpha$$

Given One Side and Three Angles — b, α, β, γ,

$$\text{Area} = \frac{b^2}{2}\cdot\frac{\sin\alpha\,\sin\gamma}{\sin\beta}$$

Given Two Sides and the Angle opposite one of them — a, c, α

$\sin\gamma = \frac{c}{a}\sin\alpha = \sin\gamma'$

$\beta = 180° - (\alpha + \gamma)$; $b = \frac{a}{\sin\alpha}\sin\beta = \frac{c}{\sin\gamma}\sin\beta$

$\beta' = 180° - (\alpha + \gamma')$; $b' = \frac{a}{\sin\alpha}\sin\beta' = \frac{c}{\sin\gamma'}\sin\beta'$

$$\text{Area} = \tfrac{1}{2}ac\sin\beta$$

45° sin = cos = $1/\sqrt{2}$; tan = cot = 1; sec = cosec = $\sqrt{2}$

30°	sin	cos	tan	cot	sec	cosec
Values	$\frac{1}{2}$	$\sqrt{3}/2$	$1/\sqrt{3}$	$\sqrt{3}$	$2/\sqrt{3}$	2
60°	cos	sin	cot	tan	cosec	sec

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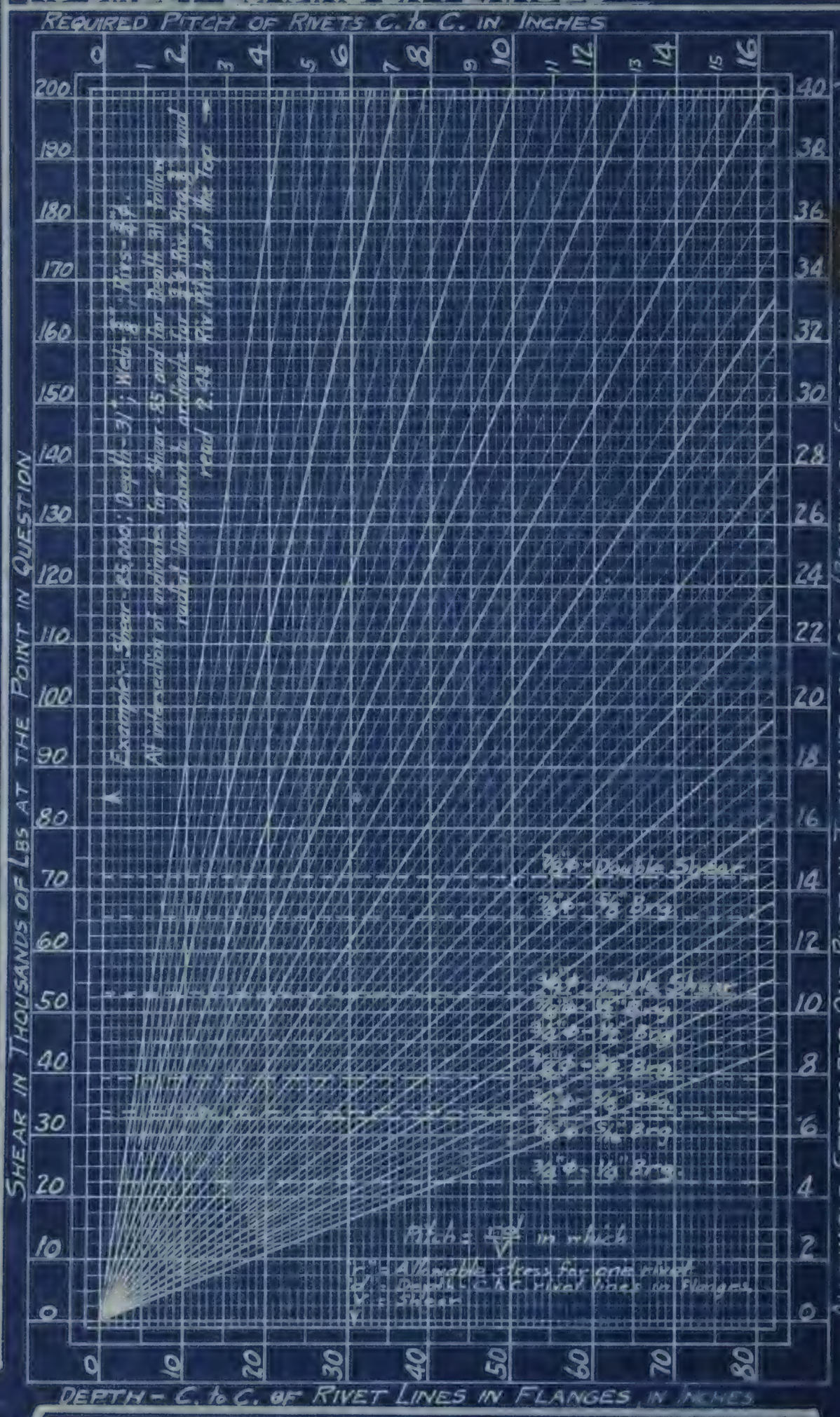
G9.181 a

Rivet Pitch of Plate Girder Flanges

No Direct Loading on Flanges —


Required Pitch of Rivets C. to C. in Inches
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
40 38 36 34 32 30 28 26 24 22 20 18 16 14 12 10 8 6 4 2 0
Example: Shear 23,000 : Depth 31" : Rivets 7/8" dia.
At the section of maximum shear 85 and the depth 31 ratio
read 2.44 Rivet Pitch of the Top
Pitch = V/d in which
V = Allowable stress for one rivet
d = Depth C. to C. Rivet Lines in Flanges
V = Shear
Shear in Thousands of Lbs at the Point in Question
Allowable Stress for One Rivet in Thousands of Lbs (Bearing or Shear - which is the less)
Depth - C. to C. of Rivet Lines in Flanges in Inches

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ALLOWABLE SHEAR FOR WEB PLATES

Safe Shear per □" = $\frac{16000}{1+\frac{d^2}{3000T^2}}$

in which

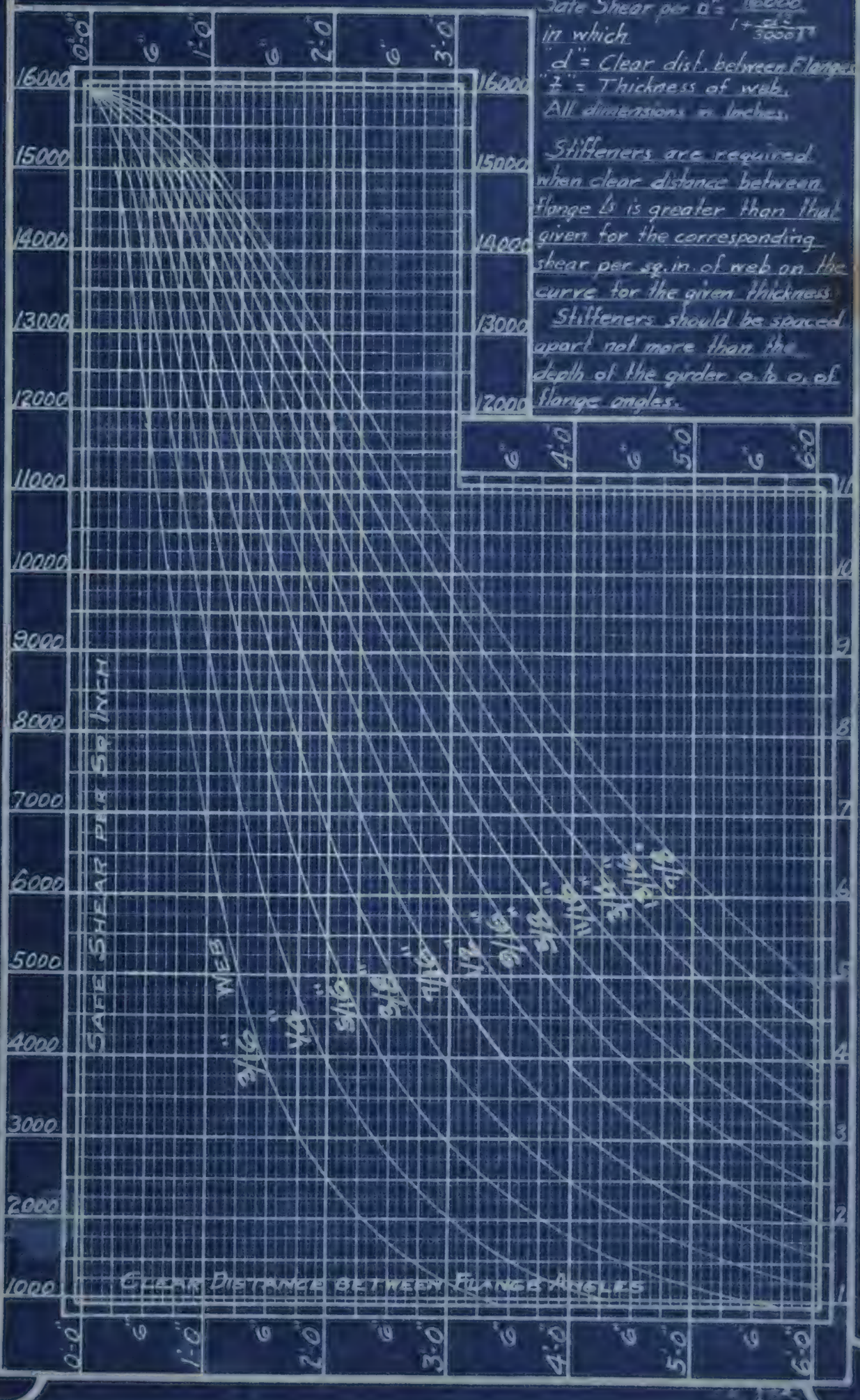
"d" = Clear dist. between Flanges

"T" = Thickness of web.

All dimensions in Inches.

Stiffeners are required when clear distance between flange Ls is greater than that given for the corresponding shear per sq. in. of web on the curve for the given thickness.

Stiffeners should be spaced apart not more than the depth of the girder c. to c. of flange angles.



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As Approved

CARNEGIE "H's" (Mine Timbers)

Thicknesses are given to the nearest 1/16". Gauges for connection angles are to be determined by the 1/2 Web values given in Table. Max. Moment is based on extreme fiber stress of 16000# per sq. in. Max. Vert. End Shears are based upon a hor. shear at N. Axis of 10000# per sq. in. Crushing Values are safe. Moments, Loads & Shears are given in Thousands of Lbs. Loads on web without Stiffeners

"H" Depth	Weight Lbs. per Ft.	Area Sq. Ins.	Flange	Web	1/2 Web	Tangent Dist. T	k	f Gauge	b Grip	Max. Rivet in Flange	BEAM Max. Mom. Ft. Lbs.	Web Resistance Max. Vert. End Sh.	Gen. Ltd. by Bend.	Crushing Ft. Lbs. on Web	Brg. Pl.	Std. Brg. on Wall	r = Least Rad. of Gyration
4	13.6	4.0	4	5/16	3/16	2 1/2	3/4	2 1/4	3/8	3/4	7.1	10.8	2'8	5.0	6x6	6	.93
5	18.7	5.5	5	"	"	3 3/8	13/16	3	7/16	"	12.7	13.7	3'9	"	"	"	1.21
6	23.8	7.0	6	"	"	4 1/4	7/8	3 3/4	1/2	7/8	20.1	16.6	4'10	"	1	"	1.49
8	34.0	10.0	8	3/8	"	6 1/4	7/8	5	1/2	"	38.5	26.7	5'9	6.0	—	8"	1.87

"H" as Struts - Safe Load in Thousands of Lbs - Compression = 16000 - 70 l/r. For Values above Heavy Line, the l/r does not exceed 125; below Heavy Line, the l/r does not exceed 150.

"H" as Beams - Safe Load in Thousands of Lbs. Tension = 16000# per sq. in. Deflection at Center in inches = Coef. ÷ Depth of Bm. for U.L., = 4/5 Coef ÷ Depth of Bm. for C.L. at center. For Bms without Lateral Support reduce Tabulated Loads as follows:-

20 × Flg. Width = Full Load	40 × Flg. Width = 8/10 Load	60 × Flg. Width = 6/10 Load
30 × " " = 9/10 "	50 × " " = 7/10 "	70 × " " = 5/10 "

Unsupported Length of Col. Ft.	COLUMN 4"	5"	6"	8"	BEAM 4"	5"	6"	8"	Def. Coef.	Span of Bm. in Ft.
2					28.5				.066	2
3	53.4	76.5	99.8	146.6	19.0				.149	3
4	47.9	72.6	95.8	142.0	14.3	25.4			.265	4
5	46.3	68.8	92.0	137.6	11.4	20.3	32.1		.414	5
6	42.8	64.9	87.6	133.1	9.5	16.9	26.7	51.3	.596	6
7	39.2	61.1	83.7	128.9	8.1	14.5	22.9	44.0	.811	7
8	35.7	57.2	79.5	124.1	7.1	12.7	20.1	38.5	1.059	8
9	32.2	53.4	75.5	119.6	6.3	11.3	17.8	34.2	1.341	9
10	28.6	49.5	71.5	115.1	5.7	10.1	16.0	30.8	1.655	10
11	25.1	45.7	67.3	110.6	5.2	9.2	14.6	28.0	2.003	11
12		41.8	63.4	106.1	4.8	8.5	13.4	25.7	2.383	12
13		38.0	58.8	101.6	4.4	7.8	12.3	23.7	2.797	13
14		34.1	55.2	97.1	4.1	7.2	11.5	22.0	3.244	14
15		30.3	51.2	92.6	3.8	6.8	10.7	20.5	3.724	15
16			47.1	88.1	3.6	6.3	10.0	19.2	4.237	16
17			43.1	83.6		6.0	9.4	18.1	4.783	17
18			38.9	79.1		5.6	8.9	17.1	5.363	18
19				74.6			8.4	16.2	5.975	19
20				70.2			8.0	15.4	6.621	20
21				65.7				14.7	7.299	21
22				61.2				14.0	8.011	22
23				56.7				13.4	8.756	23
24								12.8	9.534	24

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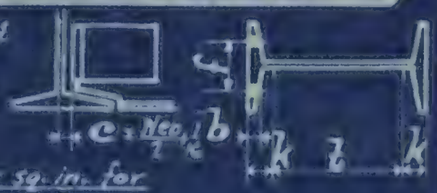
BEAMS – "I"

Flange Widths + Web Thicknesses are given to the nearest 1/16

Gauges for Connection Angles are to be determined by the 1/2 Web Thicknesses as given below.

Max. Moment is based on extreme fiber stress of 16000* per sq. in. for Carnegie Sections. Moment for Pencoyd Sections approx. the same.



"I" Depth	Weight in Lbs. per Ft.	CARNEGIE Flange	Web	1/2 Web	Tangent Dist. t	k	PENCOYD Flange	Web	1/2 Web	Tangent Dist. t	k	Max. Bndg. Mom. in Ft.Lbs. at Thos. Lbs.	Gauge "f"	Grip "b"	Dist. "c"	Max. Rivet in Flange	Std. Brg. on Wall	Std. Brg. Pls.
27	83	7 1/2	7/16	3/16	21 5/8	2 11/16	Double Curve Fillet					285	4	7/8	1/4	7/8		
24	115	8	3/4	3/8	20 1/4	1 7/8						378	4	1 1/8	7/16	7/8		
	100	7 1/4	"	"	20 3/4	1 5/8						264	"	7/8	"	"		
	95	7 3/16	11/16	"	"	"						257	"	"	"	"		
	90	7 1/8	5/8	5/16	"	"						249	"	"	3/8	"		
	85	7 1/16	9/16	"	"	"						241	"	"	"	"		
	80	7	1/2	1/4	"	"						232	"	"	5/16	"		
	69.5	7	3/8	3/16	19	2 1/2	Double Curve Fillet					214	"	3/4	1/4	"		
21	57.5	6 1/2	3/8	3/16	16 1/4	2 1/4	"		"			156	4	1/4	1/4	7/8		
20	100	7 5/16	7/8	7/16	16 1/2	1 3/4	7	7/8	7/16	16	2	221	4	1	1/2	7/8		
	95	7 3/16	13/16	"	"	"	6 15/16	3/4	3/8	"	"	214	"	"	"	"		
	90	7 1/8	3/4	3/8	"	"	6 7/8	11/16	5/16	"	"	208	"	"	7/16	"		
	85	7 1/16	11/16	"	"	"	6 7/8	5/8	"	16 1/2	1 3/4	201	"	"	3/8	"		
	80	7	5/8	5/16	"	"	6 3/4	"	"	"	"	196	"	"	"	"	16"	
	75	6 3/8	11/16	"	17	1 1/2	6 11/16	9/16	"	"	"	169	"	3/4	"	"		
	70	6 5/16	9/16	"	"	"	6 7/16	"	"	17	1 1/2	163	"	"	"	"		
	65	6 1/4	1/2	1/4	"	"	6 1/4	1/2	1/4	"	"	156	"	"	5/16	"		
18	90	7 1/4	13/16	7/16	14 1/2	1 3/4						186	4	1	1/2	7/8		
	85	7 3/16	3/4	3/8	"	"						181	"	"	7/16	"		
	80	7 1/16	5/8	5/16	"	"						175	"	"	3/8	"		
	75	7	9/16	"	"	"						169	"	"	"	"		
	70	6 1/4	3/4	3/8	15 1/4	1 7/8	6 9/16	5/8	5/16	14 3/4	1 5/8	136	3 3/4	3/4	7/16	"		
	65	6 3/16	5/8	5/16	"	"	6 1/2	1/2	1/4	"	"	131	"	"	3/8	"		
	60	6 1/8	9/16	"	"	"	6 1/4	"	"	15 1/4	1 7/8	125	"	"	"	"		
	55	6	1/2	1/4	"	"	6	"	"	"	"	118	"	"	5/16	"		
	46	6	5/16	3/16	14	2	Double Curve Fillet					109	"	5/8	1/4	"		
15 * heavy	100	6 3/4	1 3/16	5/8	11	2	6 3/4	1 3/16	5/8	11	2	160	3 3/4	1	5/8	7/8		
	95	6 11/16	1 1/8	9/16	"	"	6 9/16	1 1/8	9/16	"	"	155	"	"	"	"		
	90	6 9/16	1	1/2	"	"	6 9/16	1	1/2	"	"	150	"	"	9/16	"		
	85	6 1/2	7/8	7/16	"	"	6 1/2	7/8	7/16	"	"	145	"	"	1/2	"		
	80	6 3/8	13/16	"	"	"	6 5/8	13/16	"	"	"	141	"	"	"	"		
	75	6 5/16	7/8	"	11 3/4	1 5/8	6 9/16	3/4	3/8	11 1/2	1 3/4	123	3 1/2	7/8	"	3/4		
	70	6 3/16	13/16	3/8	"	"	6 7/16	5/8	5/16	"	"	118	"	"	7/16	"		
	65	6 1/8	11/16	"	"	"	6 3/8	"	"	"	"	113	"	"	"	"	17"	
	60	6	5/8	5/16	"	"	6 3/16	9/16	"	11 3/4	1 5/8	108	"	"	3/16	"		
	55	5 3/4	11/16	"	12 1/2	1 1/4	5 15/16	"	"	12	1 1/2	91	"	5/8	"	"		
	50	5 5/8	9/16	"	"	"	5 13/16	1/2	1/4	12 1/4	1 3/8	86	"	"	"	"		
	45	5 9/16	1/2	1/4	"	"	5 5/8	7/16	"	12 1/2	1 1/4	81	"	"	5/16	"		
	42	5 1/2	7/16	3/16	"	"	5 1/2	"	3/16	"	"	79	"	"	1/4	"		
Light	36	5 1/2	5/16	1/8	11 3/8	1 13/16	Double Curve Fillet					72	"	"	3/16	"		

15" - 1" - 1'-4" Pl. Wt. - 73*

12" - 3/4" - 1'-4" Pl. Wt. - 41*

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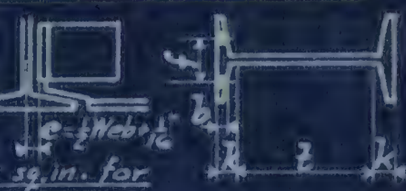
BEAMS - "I"

Flange Widths + Web Thicknesses are given to the nearest 1/16"

Gauges for Connection Angles are to be determined by the 1/2 Web Thicknesses as given below.

Max. Moment is based on extreme fiber stress of 16000# per sq. in. for Carnegie Sections. Moments for Pencoyd Sections approx. the same.



"I"		CARNEGIE					PENCOYD										
Depth	Weight #" lbs per Ft	Flange	Web	1/2 Web	Tangent Dist t	k	Flange	Web	1/2 Web	Tangent Dist t	k	Max Bndg Mom in Ft Lbs in Thos. Lbs	Guage "f"	Grip "b"	Dist "c"	Max. Rivet in Flange	Std. Brg. on Wall	Std Brg. Pls.
12	65						6 1/16	7/8	7/16	8 3/4	1 5/8	90.0	3 1/2	7/8	1/2	3/4	12"	12"x 3/4"x 1'-0" w/ 3 #'s
	60						5 15/16	3/4	3/8	"	"	86.0	"	"	7/16	"		
	55	5 5/8	13/16	7/16	9 1/4	1 3/8	5 13/16	5/8	5/16	"	"	71.0	"	3/4	1/2	"		
	50	5 1/2	11/16	3/8	"	"	5 11/16	1/2	1/4	9	1 1/2	67.0	"	"	7/16	"		
	45	5 3/8	9/16	5/16	"	"	5 5/8	"	"	9 1/4	1 3/8	63.0	3	"	3/8	"		
	40	5 1/4	1/2	1/4	"	"	5 1/4	3/8	3/16	9 1/2	1 1/4	60.0	"	"	5/16	"		
	35	5 1/16	7/16	"	9 3/4	1 1/8	5 1/8	"	"	9 3/4	1 1/8	51.0	"	9/16	"	"		
	31 1/2	5	3/8	3/16	"	"	5	"	"	"	"	48.0	"	"	1/4	"		
	27 1/2	5	1/4	1/8	8 3/4	1 7/16	Double Curve Fillet					44.0	"	1/2	3/16	"		
10	40	5 1/8	3/4	3/8	8	1	5 3/16	9/16	5/16	7 1/2	1 1/4	42.0	2 3/4	1/2	7/16	3/4	8"	8"x 1/2"x 1'-0" w/ 4 #'s
	35	4 15/16	5/8	5/16	"	"	5 1/16	7/16	3/16	"	"	39.0	"	"	3/8	"		
	30	4 13/16	1/2	1/4	"	"	4 3/4	3/8	"	7 3/4	1 1/8	36.0	"	"	5/16	"		
	25	4 11/16	5/16	3/16	"	"	4 11/16	5/16	"	8	1	33.0	"	"	1/4	"		
	22	4 11/16	1/4	1/8	7 1/8	1 7/16	Double Curve Fillet					30.0	"	7/16	3/16	"		
9	35	4 3/4	3/4	3/8	7	1	4 7/8	1/2	1/4	6 1/2	1 1/4	33.0	2 1/2	1/2	7/16	3/4		
	30	4 5/8	9/16	5/16	"	"	4 7/16	"	"	6 3/4	1 1/8	30.0	"	"	3/8	"		
	25	4 7/16	7/16	3/16	"	"	4 5/8	3/8	3/16	7	1	27.0	"	"	1/4	"		
	21	4 5/16	5/16	1/8	"	"	4 5/16	5/16	1/8	"	"	25.0	"	"	3/16	"		
8	25 1/2	4 1/4	9/16	5/16	6 1/2	7/8	4 1/2	1/2	1/4	6	1	23.0	2 1/4	1/2	5/16	3/4	8"	8"x 1/2"x 8" w/ 12 #'s
	23	4 3/16	7/16	1/4	"	"	4 3/8	3/8	3/16	"	"	21.0	"	7/16	"	"		
	20 1/2	4 1/16	3/8	3/16	"	"	4 5/16	5/16	1/8	"	"	20.0	"	"	1/4	"		
	18	4	1/4	1/8	"	"	4	1/4	"	6 1/4	7/8	19.0	"	"	3/16	"		
	17 1/2	4 5/16	3/16	1/8	5 3/8	1 5/16	Double Curve Fillet					19.0	"	"	"	"		
7	20	3 7/8	1/2	1/4	5 1/2	7/8	4	3/8	3/16	5 1/4	7/8	16.0	2 1/4	3/8	5/16	5/8		
	17 1/2	3 3/4	3/8	3/16	"	"	3 7/8	1/4	1/8	"	"	15.0	"	"	1/4	"		
	15	3 11/16	1/4	1/8	"	"	3 11/16	1/4	"	"	"	14.0	"	"	3/16	"		
6	17 1/4	3 7/16	1/2	1/4	4 1/2	3/4	3 3/4	3/8	3/16	4 1/4	7/8	11.6	2	3/8	5/16	5/8	6"	6"x 1/2"x 6" w/ 5 #'s
	14 3/4	3 5/16	3/8	3/16	"	"	3 5/8	1/4	1/8	"	"	10.7	"	"	1/4	"		
	12 1/4	3 5/16	1/4	1/8	"	"	3 5/16	"	"	4 1/2	3/4	9.7	"	"	3/16	"		
5	14 3/4	3 5/16	1/2	1/4	3 1/2	3/4	3 1/2	7/16	1/4	3 1/2	3/4	8.1	1 3/4	3/8	5/16	1/2		
	12 1/4	3 1/8	3/8	3/16	"	"	3 3/8	1/4	1/8	"	"	7.3	"	"	1/4	"		
	9 3/4	3	1/4	1/8	"	"	3	"	"	3 3/4	5/8	6.4	"	"	3/16	"		
4	10 1/2	2 7/8	7/16	1/4	2 3/4	5/8	2 7/8	3/8	3/16	2 3/4	5/8	4.8	1 1/2	5/16	1/4	1/2		
	9 1/2	2 13/16	3/8	3/16	"	"	2 13/16	5/16	"	"	"	4.5	"	"	"	"		
	8 1/2	2 3/4	1/4	1/8	"	"	2 3/4	1/4	1/8	"	"	4.2	"	"	3/16	"		
	7 1/2	2 11/16	3/16	"	"	"	2 11/16	3/16	"	"	"	4.0	"	"	"	"		
3	7 1/2	2 1/2	3/8	3/16	1 3/4	5/8	2 1/2	5/16	3/16	1 3/4	5/8	2.1	1 1/2	5/16	1/4	3/8		
	6 1/2	2 7/16	1/4	1/8	"	"	2 7/16	1/4	1/8	"	"	2.4	"	"	3/16	"		
	5 1/2	2 5/16	3/16	"	"	"	2 5/16	3/16	"	"	"	2.2	"	"	1/8	"		

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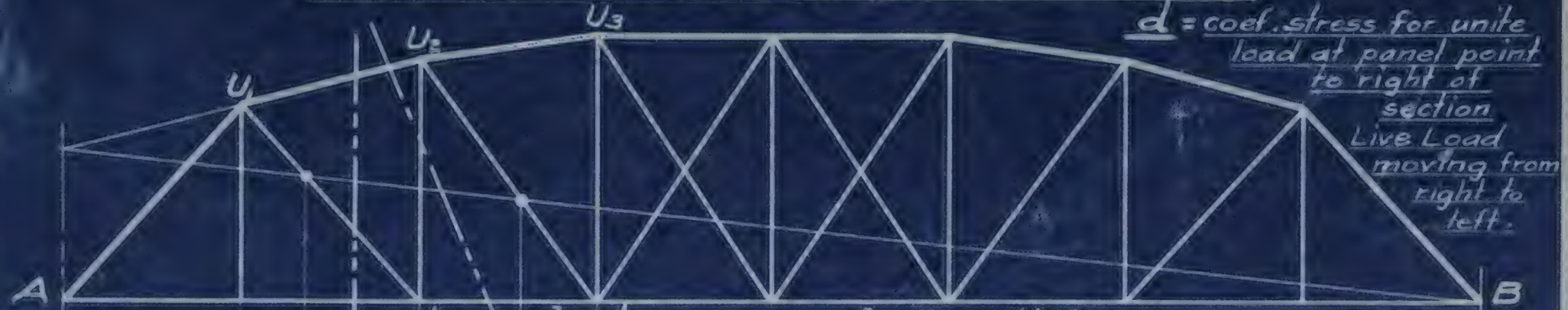
INFLUENCE LINES
LIVE LOAD STRESSES - UNIFORM - WHEEL



d = coef. stress for unite load at panel point to right of section
Live Load moving from right to left.

For Tension Members - DEB = +, ACB = −
For Comp. Members - DEB = −, ACB = +
D = point of zero stress

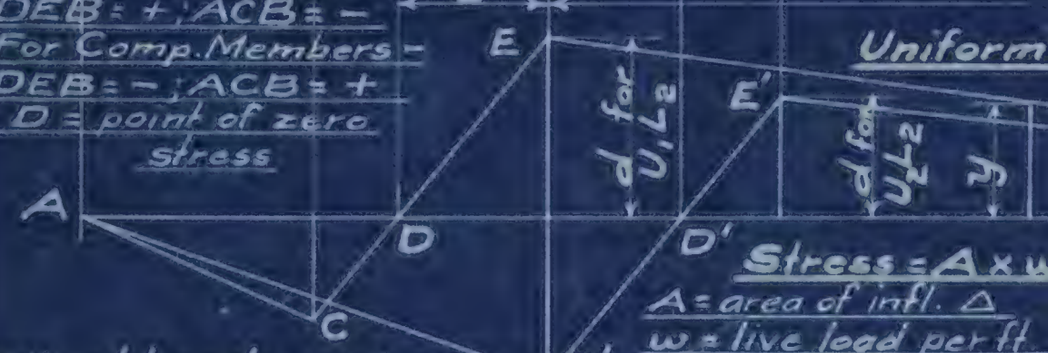


Fig. 2

Uniform Load - Fig 2 - P = any load, y = its ordinate to influence line DEB : P × y = tension in U_1L_2 . ∴ If w = live load per lin. ft. and

Stress = A × w
A = area of infl. △
w = live load per ft

A = area of influence △ DEB
A × w = max. stress (tension) in U_1L_2

Wheel Loads - Fig. 3 -

$$\text{Stress} = \Sigma P y \; ; \; y = \frac{dx_1}{l} - \left(\frac{dx_2}{l} + \frac{dx_2}{b} \right)$$

$$\therefore \quad " \quad = \Sigma P x_1 \left(\frac{d}{l} \right) - \Sigma P x_2 \left(\frac{d}{l} + \frac{d}{b} \right)$$

l = dist. from point "L" on right of section to right support
$\Sigma P x_1 = M$ = Moment of total load about right support
$\Sigma P x_2 = M'$ = " " " load on the left of "L" about "L"

$$\text{Stress} = (M - M')\frac{d}{l} - M'\left(\frac{d}{b}\right)$$

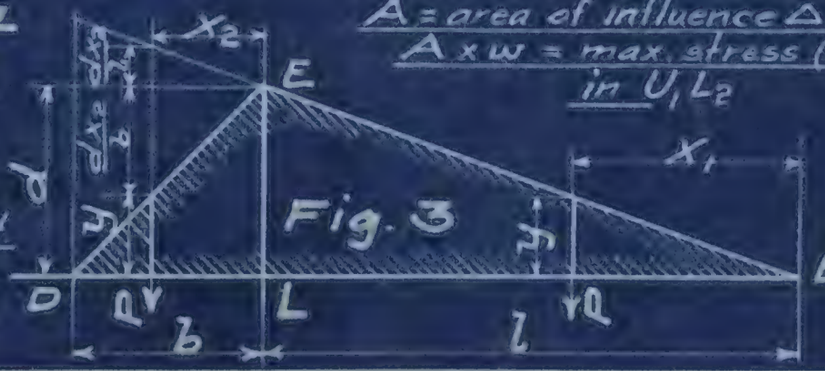


Fig. 3

I 14.06 19

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INFLUENCE - LINES

COEFFICIENT "d" - ANALYTICAL - GRAPHICAL

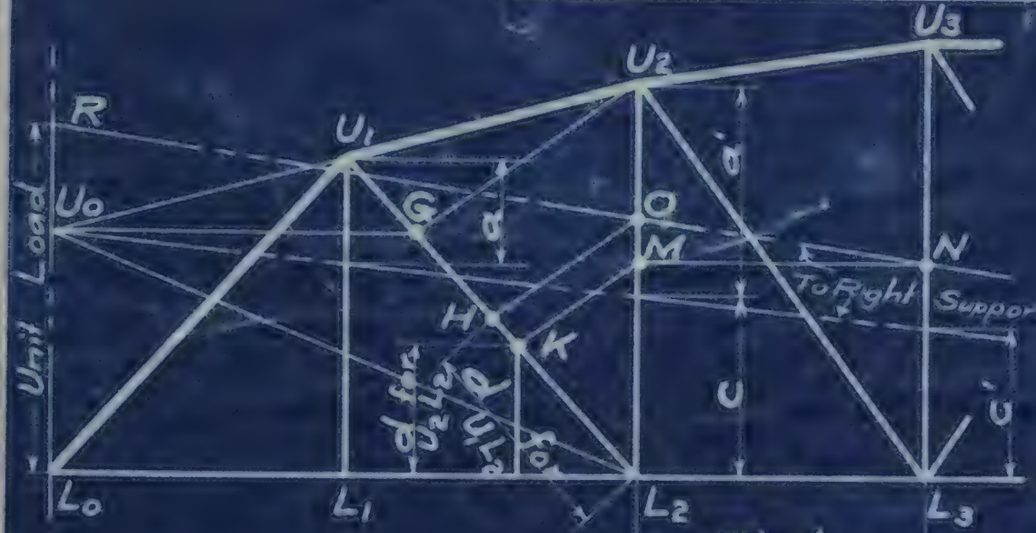

Fig.1

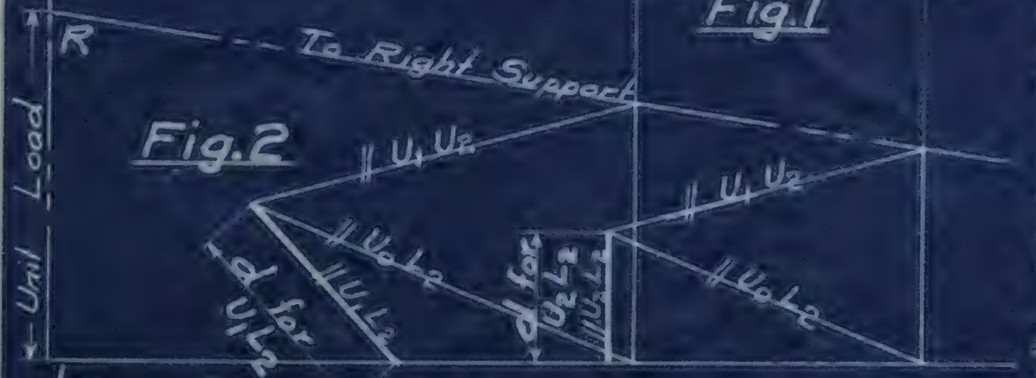

Fig.2

ANALYTICALLY - SEE FIG.1

Diagonal - U_1L_2 - Tension - Unit Load at L_2

$+d = \frac{(6h-3h')m}{8hh'}$; But $C = \frac{6h-3h'}{8}$; $\therefore +d = \frac{cm}{hh'}$

Compression - Unit Load at L_1

$-d = -\frac{(6h-7h')m}{8hh'}$; But $a = -\frac{7h'-6h}{8}$; $\therefore -d = \frac{am}{hh'}$

Post - U_2L_2 - Compression - Unit Load at L_3

$-d = -\frac{10h-5h'}{8h'}$; But $c' = \frac{10h-5h'}{8}$; $\therefore -d = \frac{c'}{h'}$

Tension - Unit Load at L_2

$+d = -\frac{12h-14h'}{8h'}$; But $a' = -\frac{14h'-12h}{8}$; $\therefore +d = \frac{a'}{h}$

GRAPHICALLY - SEE FIG.1

On a vertical above left support lay off a unit of load to a convenient scale (as L_0R). From this point draw load line to right support. From intersection of top chord member for section considered, and vertical from left support (as U_0) draw a horizontal line until it cuts the diagonal or diagonal extended of this section (as G). Parallel to the line between this point and the intersection of top chord member and vertical from intersection of diagonal or diagonal extended and the bottom chord (as GU_2) draw a line from the intersection of load line for unity and vertical on right of section (as C) to cut diagonal or diagonal extended (as at H). From this point to intersection of diagonal or diagonal extended and the bottom chord gives the "d" for the diagonal of the section (as HL_2).

For posts, the point where the load line cuts the vertical on the right of the section (as at N) must be transfered one panel to the left (as at M). As for the diagonal, the line from this point (as MK) cuts the diagonal in a point (as K), the vertical distance to which from the bottom chord gives the "d" for the post.

Another method is shown in Fig.2.

I14.091.8

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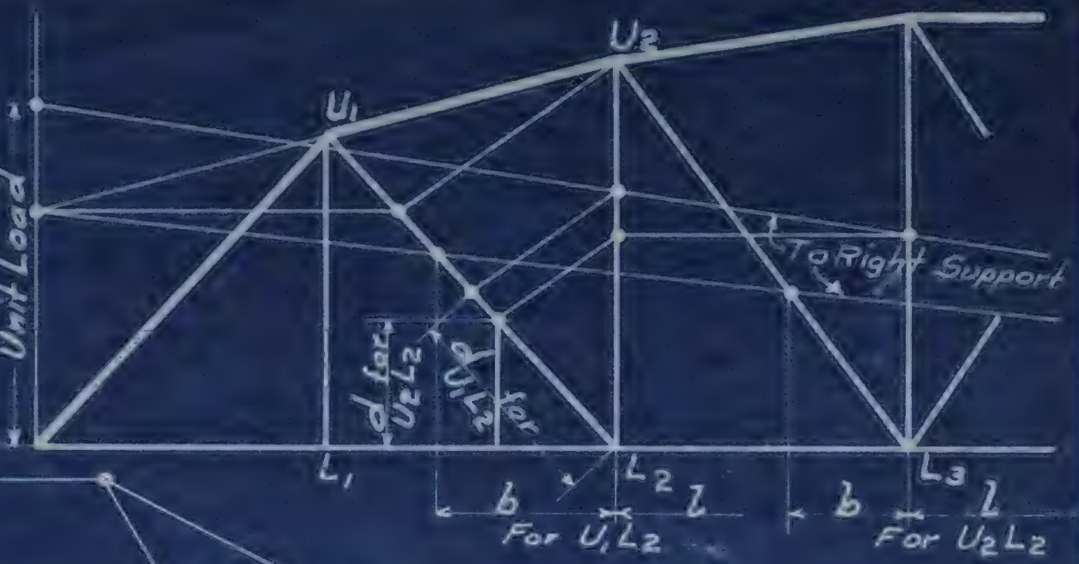
INFLUENCE LINES
GRAPHICAL METHOD - EXAMPLES

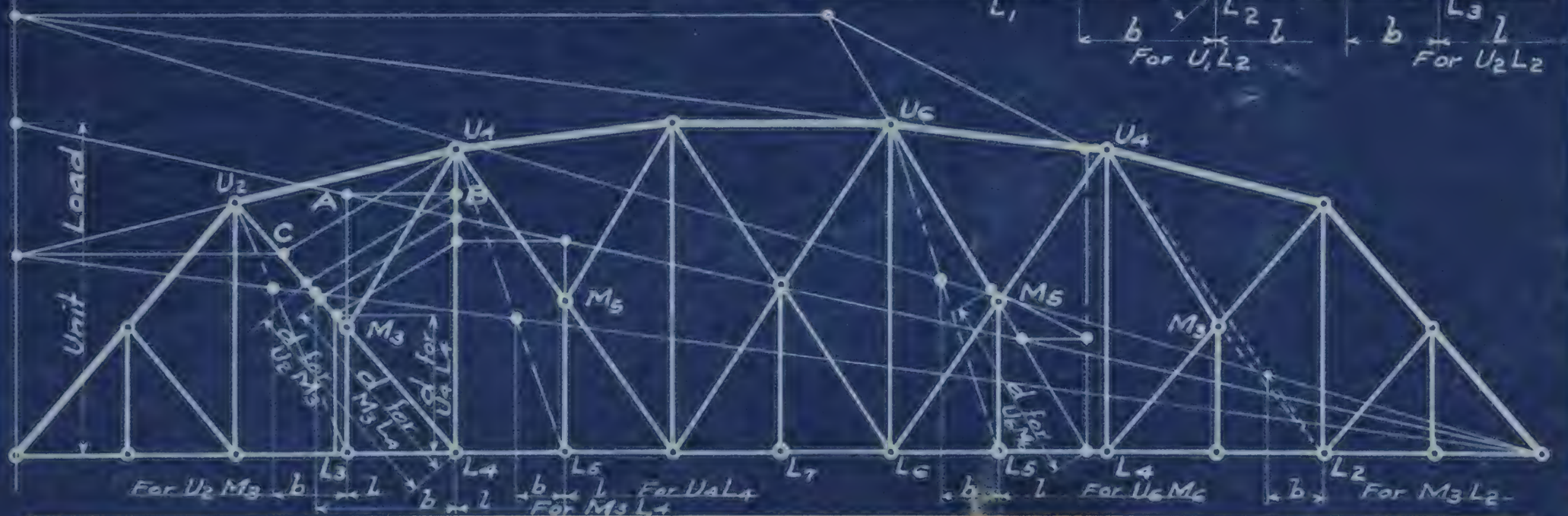
GENERAL NOTES -

The Live Load enters bridge at right end and moves to the left.

Points as A, for members like U_2M_3 should be transfered one panel to the right, as at B, before the line from which be drawn parallel to the line like CU_4.

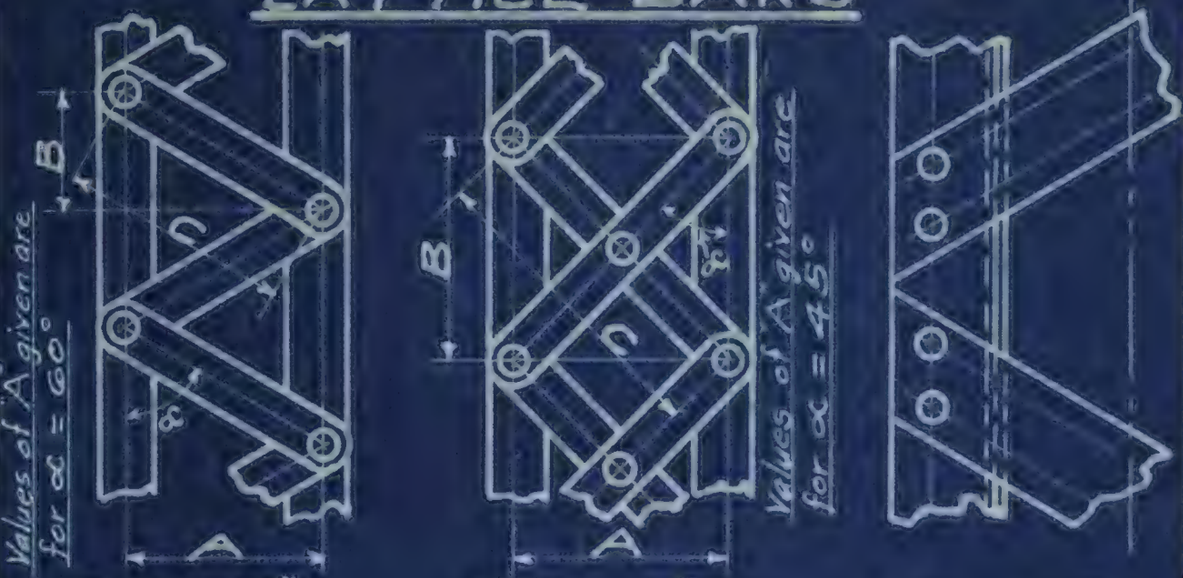
If M_3L_2 existed, b would be found as shown.





H14.061C

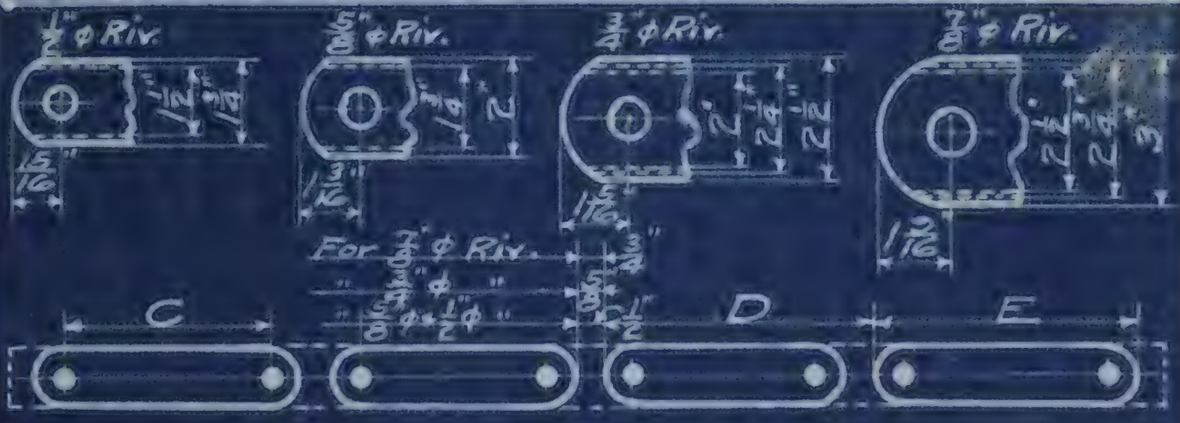
LATTICE BARS



STYLE #1 STYLE #2 STYLE #3

Max. Dist. "C" + "A" in Ft. + Ins. for given Thickness "T" of Bar.

Thickn. of Bar	Single Lacing C = 40 T		Single Lacing C = 50 T		Double Lacing C = 60 T		Double Lacing C = 75 T	
T	A	C	A	C	A	C	A	C
5/8	1-9 5/8	2'-1"	2'-3 1/16	2'-7 1/4"	2'-2 1/2"	3'-1 1/2"	2'-9 1/8"	3'-10 5/8"
9/16	1-7 1/2	1-10 1/2	2-0 3/8	2-4 1/8	1-11 7/8	2-9 3/4	2-5 13/16	3-6 3/16
1/2	1-5 5/16	1-8	1-9 5/8	2-1	1-9 1/16	2-6	2-2 1/2	3-1 1/2
7/16	1-3 1/8	1-5 1/2	1-6 15/16	1-9 7/8	1-6 3/16	2-2 1/4	1-11 3/16	2-8 1/16
3/8	1-1	1-3	1-4 1/4	1-6 3/4	1-3 1/16	1-10 1/2	1-7 7/8	2-4 3/8
5/16	0-10 13/16	1-0 1/2	1-1 3/16	1-3 5/8	1-1/4	1-6 3/4	1-4 9/16	1-11 7/16
1/4	0-8 11/16	0-10	0-10 1/16	1-0 1/2	0-10 5/8	1-3	1-1/4	1-6 3/4



Length to be added to Dist. "C" for various sized Rivets.

Width of Bar in Inches	For Finished Length "E" 1/2"	5/8"	3/4"	7/8"	For Ordered Length "D" 1/2"	5/8"	3/4"	7/8"
3				3 1/8				3 1/8
2 3/4				3 1/8				3 1/8
2 1/2			2 5/8	3 1/8			3 1/4	3 1/8
2 1/4			2 5/8				3 1/4	
2		2 3/8	2 5/8			2 7/8	3 1/4	
1 3/4	1 7/8	2 3/8			2 3/8	2 7/8		
1 1/2	1 7/8				2 3/8			

C.B.Co's Standard.
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- A.B.Co's Standard -

As Approved:- 10-19-09.

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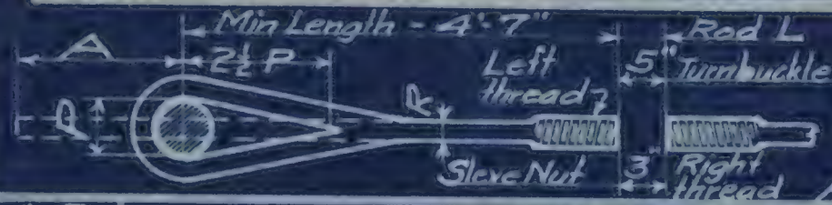

- Loop Rods -

Additional Length "A" = 4.17 P + 5.89 R

Max. Shipping Length of Rod = 35'-0"

Rods marked # are special.

ADDITIONAL LENGTH "A" IN FT. + INS. FOR ONE LOOP

Dia. Pin "P" Ins.	Diameter or side of Rod "R"										
	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	1 7/8	2
1 1/8	0-9½	0-10	0-11	0-11½							
1 1/4	0-10	0-10½	0-11½	1-0	1-1						
1 1/2	0-11	0-11½	1-0½	1-1	1-2	1-2½					
1 3/4	1-0	1-0½	1-1½	1-2	1-3	1-3½	1-4½	1-5	1-6		
2	1-1	1-1½	1-2½	1-3	1-4	1-4½	1-5½	1-6	1-7	1-7½	1-8½
2 1/4	1-2	1-3	1-3½	1-4½	1-5	1-5½	1-6½	1-7	1-8	1-8½	1-9½
2½	1-3	1-4	1-4½	1-5½	1-6	1-7	1-7½	1-8	1-9	1-9½	1-10½
2 3/4	1-4	1-5	1-5½	1-6½	1-7	1-8	1-8½	1-9½	1-10	1-11	1-11½
3	1-5	1-6	1-6½	1-7½	1-8	1-9	1-9½	1-10½	1-11	2-0	2-0½
#3 1/4	1-6	1-7	1-7½	1-8½	1-9	1-10	1-10½	1-11½	2-0	2-1	2-1½
3½	1-7½	1-8	1-8½	1-9½	1-10	1-11	1-11½	2-0½	2-1	2-2	2-2½
#3 3/4	1-8½	1-9	1-10	1-10½	1-11	2-0	2-0½	2-1½	2-2	2-3	2-3½
4	1-9½	1-10	1-11	1-11½	2-0½	2-1	2-2	2-2½	2-3	2-4	2-4½
#4 1/4		1-11	2-0	2-0½	2-1½	2-2	2-3	2-3½	2-4½	2-5	2-6
4½		2-0	2-1	2-1½	2-2½	2-3	2-4	2-4½	2-5½	2-6	2-7
#4 3/4		2-1	2-2	2-2½	2-3½	2-4	2-5	2-5½	2-6½	2-7	2-8
5		2-2½	2-3	2-3½	2-4½	2-5	2-6	2-6½	2-7½	2-8	2-9
#5 1/4			2-4	2-5	2-5½	2-6	2-7	2-7½	2-8½	2-9	2-10
5½			2-5	2-6	2-6½	2-7½	2-8	2-9	2-9½	2-10	2-11
#5 3/4			2-6	2-7	2-7½	2-8½	2-9	2-10	2-10½	2-11½	3-0
6			2-7	2-8	2-8½	2-9½	2-10	2-11	2-11½	3-0½	3-1
#6 1/4				2-9	2-9½	2-10½	2-11	3-0	3-0½	3-1½	3-2
6½				2-10	2-10½	2-11½	3-0	3-1	3-1½	3-2½	3-3
#6 3/4				2-11	3-0	3-0½	3-1	3-2	3-2½	3-3½	3-4
7				3-0	3-1	3-1½	3-2½	3-3	3-3½	3-4½	3-5

L15.15.1a

M5.201a

METERS, DEC. M., CENT. M., + MIL. M. TO FEET + INCHES

Units		0	1	2	3	4	5	6	7	8	9
0	Met.		3-3 3/8	6-6 3/4	9-10 1/2	13-1 1/2	16-4 7/8	19-8 1/4	22-11 1/16	26-2 15/16	29-6 5/16
	D/M		0-3 15/16	0-7 7/8	0-11 13/16	1-3 3/4	1-7 11/16	1-11 5/8	2-3 9/16	2-7 1/2	2-11 7/16
	C/M		0-0 3/8	0-0 13/16	0-1 3/16	0-1 9/16	0-1 15/16	0-2 3/8	0-2 3/4	0-3 1/8	0-3 9/16
	M/M		0-0 1/16	0-0 1/16	0-0 1/8	0-0 3/16	0-0 3/16	0-0 1/4	0-0 1/4	0-0 5/16	0-0 3/8
1	Met.	3.2 9 11/16	36-1 1/16	39-4 7/16	42-7 13/16	45-11 3/16	49-2 9/16	52-5 15/16	55-9 5/16	59-0 11/16	62-4 1/16
	D/M	3-3 3/8	3-7 5/16	3-11 1/4	4-3 3/16	4-7 1/8	4-11 1/16	5-3	5-6 15/16	5-10 7/8	6-2 13/16
	C/M	0-3 15/16	0-4 5/16	0-4 3/4	0-5 1/8	0-5 1/2	0-5 7/8	0-6 5/16	0-6 11/16	0-7 1/16	0-7 1/2
	M/M	0-0 3/8	0-0 7/16	0-0 1/2	0-0 1/2	0-0 9/16	0-0 9/16	0-0 5/8	0-0 11/16	0-0 11/16	0-0 3/4
2	Met.	6.5-7 7/16	68-10 3/4	72-2 1/8	75-5 1/2	78-8 7/8	82-0 1/4	85-3 5/8	88-7	91-10 3/8	95-1 3/4
	D/M	6-6 3/4	6-10 11/16	7-2 5/8	7-6 9/16	7-10 1/2	8-2 7/16	8-6 3/8	8-10 5/16	9-2 1/4	9-6 3/16
	C/M	0-7 7/8	0-8 1/4	0-8 11/16	0-9 1/16	0-9 7/16	0-9 13/16	0-10 1/4	0-10 5/8	0-11	0-11 7/16
	M/M	0-0 13/16	0-0 13/16	0-0 7/8	0-0 7/8	0-0 15/16	0-1	0-1	0-1 1/16	0-1 1/8	0-1 1/8
3	Met.	98-5 1/8	101-8 1/2	104-11 7/8	108-3 1/4	111-6 5/8	114-9 15/16	118-1 5/16	121-4 11/16	124-8 1/16	127-11 7/16
	D/M	9-10 1/8	10-2 1/16	10-6	10-9 15/16	11-1 7/8	11-5 13/16	11-9 3/4	12-1 11/16	12-5 5/8	12-9 9/16
	C/M	0-11 13/16	1-0 3/16	1-0 5/8	1-1	1-1 3/8	1-1 3/4	1-2 3/16	1-2 9/16	1-2 15/16	1-3 3/8
	M/M	0-1 3/16	0-1 1/4	0-1 1/4	0-1 5/16	0-1 5/16	0-1 3/8	0-1 7/16	0-1 7/16	0-1 1/2	0-1 9/16
4	Met.	131-2 13/16	134-6 3/16	137-9 9/16	141-0 15/16	144-4 5/16	147-7 11/16	150-11 1/16	154-2 7/16	157-5 3/4	160-9 1/8
	D/M	13-1 1/2	13-5 7/16	13-9 3/8	14-1 5/16	14-5 1/4	14-9 3/16	15-1 1/8	15-5 1/16	15-9	16-0 15/16
	C/M	1-3 3/4	1-4 1/8	1-4 9/16	1-4 15/16	1-5 5/16	1-5 11/16	1-6 1/8	1-6 1/2	1-6 7/8	1-7 1/16
	M/M	0-1 9/16	0-1 5/8	0-1 5/8	0-1 11/16	0-1 3/4	0-1 3/4	0-1 13/16	0-1 7/8	0-1 7/8	0-1 15/16
5	Met.	164-0 1/2	167-3 7/8	170-7 1/4	173-10 5/8	177-2	180-5 3/8	183-8 3/4	187-0 1/8	190-3 1/2	193-6 7/8
	D/M	16-4 7/8	16-8 13/16	17-0 3/4	17-4 11/16	17-8 5/8	18-0 9/16	18-4 1/2	18-8 7/16	19-0 3/8	19-4 5/16
	C/M	1-7 11/16	1-8 1/16	1-8 1/2	1-8 7/8	1-9 1/4	1-9 5/8	1-10 1/16	1-10 7/16	1-10 15/16	1-11 1/4
	M/M	0-1 15/16	0-2	0-2 1/16	0-2 1/16	0-2 1/8	0-2 3/16	0-2 3/16	0-2 1/4	0-2 5/16	0-2 5/16
6	Met.	196-10 1/4	200-1 5/8	203-4 15/16	206-8 5/16	209-11 11/16	213-3 1/16	216-6 7/16	219-9 13/16	223-1 3/16	226-4 9/16
	D/M	19-8 1/4	20-0 3/16	20-4 1/8	20-8 1/16	21-0	21-3 15/16	21-7 7/8	21-11 13/16	22-3 3/4	22-7 5/8
	C/M	1-11 5/8	2-0	2-0 7/16	2-0 13/16	2-1 3/16	2-1 9/16	2-2	2-2 3/8	2-2 3/4	2-3 3/16
	M/M	0-2 3/8	0-2 3/8	0-2 7/16	0-2 1/2	0-2 1/2	0-2 9/16	0-2 5/8	0-2 5/8	0-2 11/16	0-2 11/16
7	Met.	229-7 15/16	232-11 5/16	236-2 11/16	239-6 1/16	242-9 7/16	246-0 13/16	249-4 1/8	252-7 1/2	255-10 7/8	259-2 1/4
	D/M	22-11 9/16	23-3 1/2	23-7 7/16	23-11 3/8	24-3 5/16	24-7 1/4	24-11 3/16	25-3 1/8	25-7 1/16	25-11
	C/M	2-3 9/16	2-3 15/16	2-4 3/8	2-4 3/4	2-5 1/8	2-5 1/2	2-5 5/16	2-6 5/16	2-6 11/16	2-7 1/8
	M/M	0-2 3/4	0-2 13/16	0-2 13/16	0-2 7/8	0-2 15/16	0-2 15/16	0-3	0-3 1/16	0-3 1/16	0-3 1/8
8	Met.	262-5 5/8	265-9	269-0 3/8	272-3 3/4	275-7 1/8	278-10 1/2	282-1 7/8	285-5 1/4	288-8 5/8	291-11 15/16
	D/M	26-2 15/16	26-6 7/8	26-10 13/16	27-2 3/4	27-6 11/16	27-10 5/8	28-2 9/16	28-6 1/2	28-10 7/16	29-2 3/8
	C/M	2-7 1/2	2-7 7/8	2-8 5/16	2-8 11/16	2-9 1/16	2-9 7/16	2-9 7/8	2-10 1/4	2-10 5/8	2-11 1/16
	M/M	0-3 1/8	0-3 3/16	0-3 1/4	0-3 1/2	0-3 5/16	0-3 3/8	0-3 3/8	0-3 7/16	0-3 7/16	0-3 1/2
9	Met.	295-3 5/16	298-6 11/16	301-10 1/16	305-1 7/16	308-4 13/16	311-8 3/16	314-11 9/16	318-2 15/16	321-6 5/16	324-9 11/16
	D/M	29-6 5/16	29-10 1/4	30-2 3/16	30-6 1/8	30-10 1/16	31-2	31-5 15/16	31-9 7/8	32-1 13/16	32-5 3/4
	C/M	2-11 7/16	2-11 13/16	3-0 1/4	3-0 5/8	3-1	3-1 3/8	3-1 13/16	3-2 3/16	3-2 9/16	3-3
	M/M	0-3 9/16	0-3 9/16	0-3 5/8	0-3 11/16	0-3 11/16	0-3 3/4	0-3 3/4	0-3 13/16	0-3 7/8	0-3 7/8
10	Met.	328-1 1/16	331-4 7/16	334-7 13/16	337-11 1/8	341-2 1/2	344-5 7/8	347-9 1/4	351-0 5/8	354-4	357-7 3/8
	D/M	32-9 11/16	33-1 5/8	33-5 9/16	33-9 1/2	34-1 7/16	34-5 3/8	34-9 5/16	35-1 1/4	35-5 3/16	35-9 1/8
	C/M	3-3 3/8	3-3 3/4	3-4 3/16	3-4 9/16	3-4 15/16	3-5 5/16	3-5 3/4	3-6 1/8	3-6 1/2	3-6 15/16
	M/M	0-3 15/16	0-4	0-4	0-4 1/16	0-4 1/8	0-4 1/8	0-4 3/16	0-4 3/16	0-4 1/4	0-4 5/16

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Mill Building Construction

Corrugated and Flat Sheet Steel

Gauges – Table I – U.S. Gov. Std. Thicknesses and Weights for Black Flat Iron Sheets (by Act of Congress, March 3, 1903)

Table I			Table II			
			Weight per Sq. Ft.			
			Flat Steel Shts		Corr. Steel Shts	
Gauges	Thickness Inches	Flat Iron Sheets Wt per Sq. Ft.	Black Incl. one coat pt.	Galvan-ized	Black Incl. one coat pt.	Galvan-ized
10	.1406	5.625	5.645	5.785		
12	.1093	4.375	4.395	4.535		
14	.0781	3.125	3.145	3.285		
16	.0625	2.5	2.52	2.66	2.71	2.86
18	.0500	2.	2.02	2.16	2.17	2.32
20	.0375	1.5	1.52	1.66	1.63	1.78
22	.0312	1.25	1.27	1.41	1.36	1.51
24	.0250	1.00	1.02	1.16	1.10	1.24
26	.01875	0.75	0.77	0.91	0.83	0.98
28	.0156	0.625	0.65	0.785	0.68	0.85

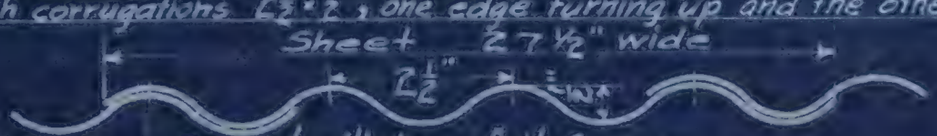
Table II. Weight of sheeting furnished by The American Sheet & Tin Plate Co. The weight for Black includes one coat of paint. Corrugations are $2\frac{1}{2}" \times \frac{1}{2}"$

Sizes of Sheets – Standard – Stock

The Stock Sizes are generally carried in stock by The American Sheet and Tin Plate Co. Corrugations are $2\frac{1}{2}" \times \frac{1}{2}"$.

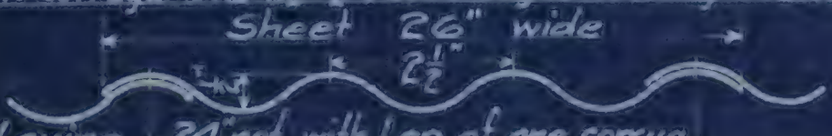
Gauges	Standard Flat Black Width	Standard Flat Black Lgth	Standard Flat Galvanized Width	Standard Flat Galvanized Lgth	Standard Corrug. Black+Galv. Width	Standard Corrug. Black+Galv. Lgth	Stock Flat Black+Galv. Width	Stock Flat Black+Galv. Lgth	Stock Corrug. Black+Galv. Width	Stock Corrug. Black+Galv. Lgth	Gauges
10	24,26,28, 30,32,34, 36,38,40, 42,44,46, 48 Inches	72,84, 96,108, 120, 144 Inches	24 26 28 30 36 Inches	72 84 96 120 Inches	$27\frac{1}{2}$ + 26 Inches	48 54 60 66 72 78 84 90 96 102 108 114 120 Inches	24 26 28 30 36 Inches	72 84 96 120 Inches	26 Inches	72 84 96 108 120 Inches	10 12 14 16 18 20 22 24 26 28
12											
14											
16											
18	42,48										
20	24	72									
22	24,26,	84									
24	28,30	96									
26	36	120									
28											

Roofing – Sheets 30" wide before corrugating + $27\frac{1}{2}$" wide after, with corrugations $2\frac{1}{2}" \times \frac{1}{2}"$, one edge turning up and the other turning down.



Laying 24" net with Lap of $1\frac{1}{2}$ Corrug.

Siding – Sheets 28" wide before corrugating + 26" wide after, with corrugations $2\frac{1}{2}" \times \frac{1}{2}"$, both edges turning the one way.



Laying 24" net with Lap of one corrug.

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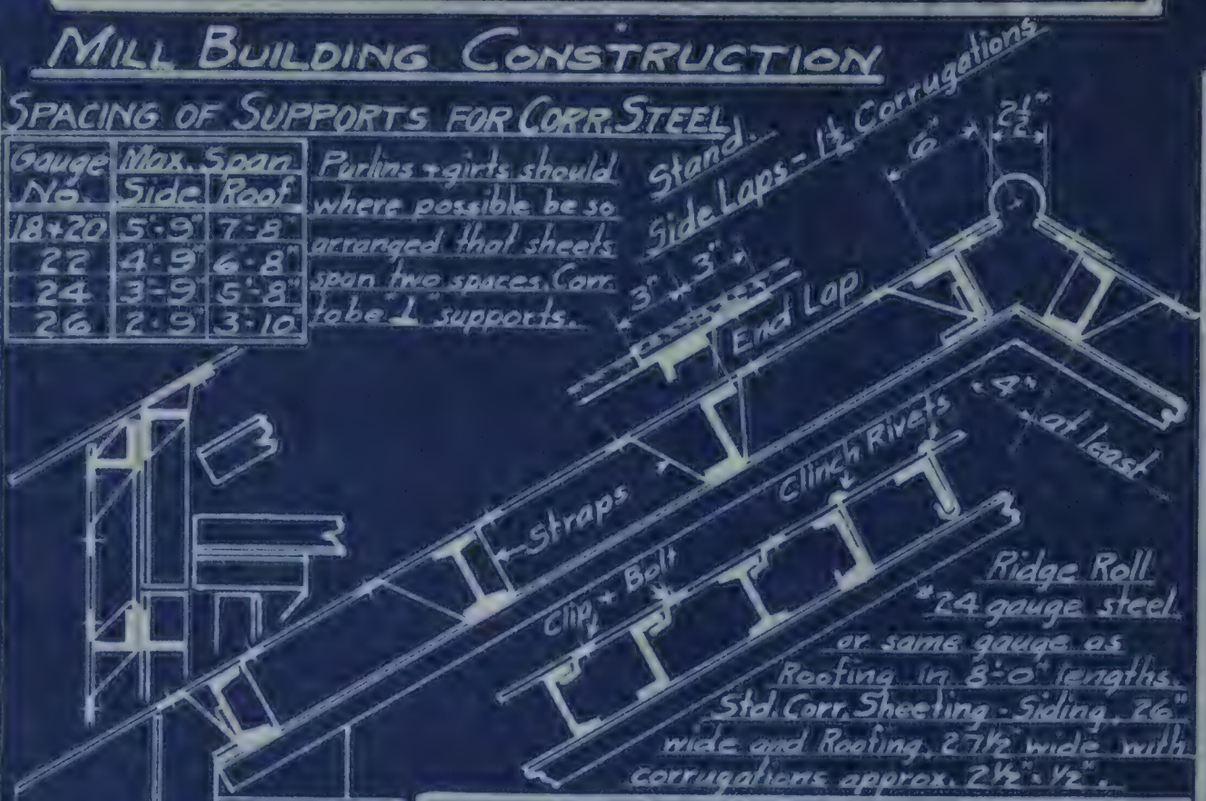
MILL BUILDING CONSTRUCTION

SPACING OF SUPPORTS FOR CORR. STEEL

Gauge No.	Max. Span Side	Max. Span Roof
18+20	5'-9"	7'-8"
22	4'-9"	6'-8"
24	3'-9"	5'-8"
26	2'-9"	3'-10"

Purlins + girts should where possible be so arranged that sheets span two spaces. Corr. to be ⊥ supports.


Stand. Side Laps - 1½ Corrugations
6" + 2½"
3" + 3"
End Lap
Straps
Clinch Rivets
4" at least
Clip + Bolt
Ridge Roll
*24 gauge steel or same gauge as Roofing in 8'-0" lengths.
Std. Corr. Sheeting - Siding, 26" wide and Roofing, 27½ wide with corrugations approx. 2½" x ½".
1'-0"
End Laps
Stand Side Laps - 1 Corrugation

END LAPS

SIDING	4"
ROOFING	6" for Roofs of 6" pitch
	8" " " " 4" "
	8" " " " less than 4" "
RIDGE ROLL	3"

RIVETING - Dist. C. to C. of Rivet or Bolt

	END LAP				SIDE LAP
	Straps	Clinch Rivets	Clip + Bolt	Nails	Closing Rivets
SIDING	12"	8"	8"	12"	12"
ROOFING	12	6	6	12	12
RIDGE ROLL					6
CORNER CAPPING					6
FLASHG to Corr. St'l					6" or less

Where nailing strips are used use 8d nails for siding and 10d nails for roofing. Where roof boards are used, use nails for end laps, side laps, and in lines parallel to end laps distant 3'-0" or 4'-0" C. to C. For ⅞" boards use 6d nails, 1⅛" + over, 8d nails.

STRAPS - ¾" x *18 steel bent at bldg. Use 2 closing rivs. ¾6" x ⅞" per strap. One 50* bundle contains 400 ft. Add 10% for waste.

CLINCH RIVETS - *10 wire

Std. lengths - 4", 5", 6", 7", 8", 9", 10", 12". Used to fasten sheeting to ⌊s + ⌊s. Should be long enough to allow 1" or more of rivet beyond last bend. Order by no. Add 10% for waste.

	⌊ Purlin or Girt				⌊ Purlin or Girt				
Depth	2"	2½-3	3½	4-4½	3"	4"	5"	6"	7"
Length	4"	5"	6"	7"	6"	7" or 8	9"	10"	11"
No. per lb.	48	38	33	27	29	21	18	16	14

CLOSING RIVETS - Order by number. Add 20% for waste.

Diam.	3/16"	3/16"	3/16"	3/16"
Length	⅜"	½"	⅝"	¾"
No. per lb.	210	185	155	140

CLIPS - 1½" - *16 steel about 2½" long. Used to fasten sheeting to ⌊s, Is + Zs. Use one bolt - *10 wire x 1" lg. per clip. Order by no. Add 10% for waste.

CORR. STEEL NAILS - 4d, 6d, 8d, 10d. Order by no. Add 20% for waste.

BOLTS - ROUND HEAD STOVE - FLAT HEAD

¼" x 1" Order by number
⅜" x 1" Add 20% for waste. *10 wire 1" + 1½" lg.

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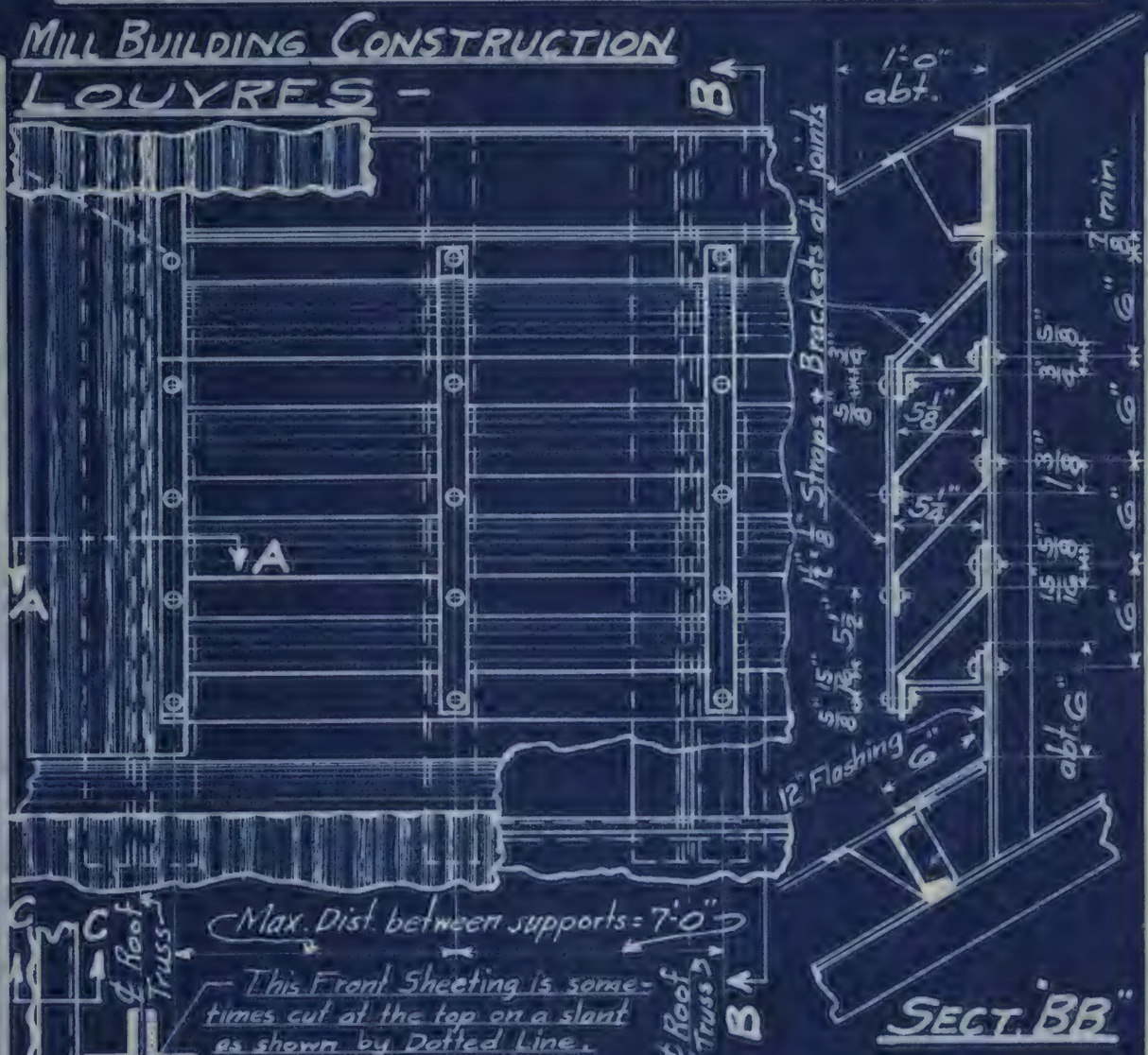
M9.123 a

MILL BUILDING CONSTRUCTION

LOUVRES -


B
A
A
1'-0" abt.
2" min.
4" x 3/16" Straps & Brackets at joints
5 1/2"
5 1/2"
5 1/2"

MILL BUILDING CONSTRUCTION

GENERAL NOTES

GAUGES – For **SIDING**, it is customary to specify two gauges lighter than for roofing. Thus; if #20 roofing is used, #22 siding is generally used.

FLASHING should be made the same gauge as the siding.

SHEET SIZES – Standard widths and lengths for corrugated steel must always be used as far as practicable. Where sizes of sheets are affected by windows, etc., requiring other than standard widths and lengths, order standard sheets to be cut in field. Where a large number of irregular sized sheets are required, such as for gable ends, etc. order by sketch and mark right and left, if in pairs.

Flashing, corner capping, etc. should be ordered in lengths of not over 8'-0".

RIVETING, ETC. – All riveting and nailing should be done through the ridge of the corrugation. No holes, under any circumstances should be put through the valley of the corrugation.

Flashing should be attached to the girts or purlins. The apron or edge projecting over the sheeting should be shaped to fit the corrugations as neatly as possible.

End and side laps of roofing are laid with Slaters Cement.

PAINTING, ETC. – All fittings and trimmings must be of the same kind as the sheeting. Thus: if the sheeting is galvanized, all fittings and trimmings, such as clips, bolts, straps, rivets, flashing, etc., are galvanized; if sheeting is black, all fittings and trimmings must be painted black.

Black corrugated steel and black flat steel should always be given one coat of paint at mill before shipment and one coat after erection. For mill coat call for Oxide of Iron unless some other brand is specified.

Galvanized sheeting is not painted unless so specified.

CORRUGATED STEEL ARCHES –

When possible use sheets of standard lengths. This can often be accomplished, where variations are permissable, by varying slightly the rise, the span, or the centre distance of the beams. Standard sheets are 26" wide and covers 24" net, allowing a side lap of one corrugation. The gauges ordinarily used are #16, #18, and #20.

Side laps should be riveted with 3/16" ϕ rivets, 12" apart.

In ordering give number of sheets required, gauge, black or galvanized, and sketch showing span, rise, and length of sheet.

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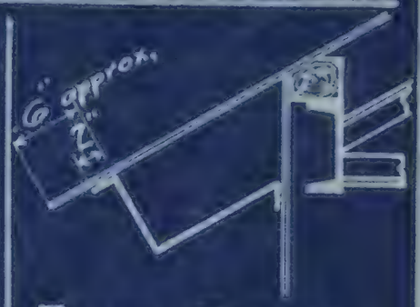
Mill Building Construction

Different Types of Corner, Gable, and Eave Finish.

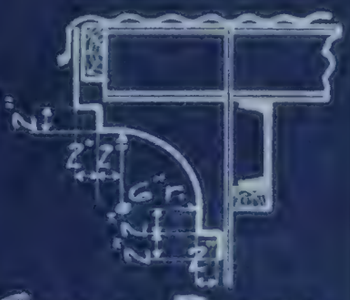
Corner Finish

Gable Finish



Eave Finish

Corner Finish



Gable Finish

Eave Finish

Corner Finish

Gable Finish

Eave Finish

General Notes on Window Details

(Flanges turned in)

(Flanges turned out)

In the following details of windows, Window Posts are not shown. When Window Posts are used, 1½" strips are used in Type B, as shown in the details, but not in Type A. When the Window Post is not used, the 1½" strips are used in both cases as shown in the details. The width of the wooden strips will depend upon existing conditions. Generally a 1½" × 3" strip can be used and sometimes a 1½" × 1½" strip.

The 2½" Strips, as shown in the details under the sills, need not be 2½" thick throughout its entire length. A 1½" Strip can be used with blocks under the jambs.

In the details, wide Stops are shown and called for. Narrower Stops can also be used. Ones judgement should be used.

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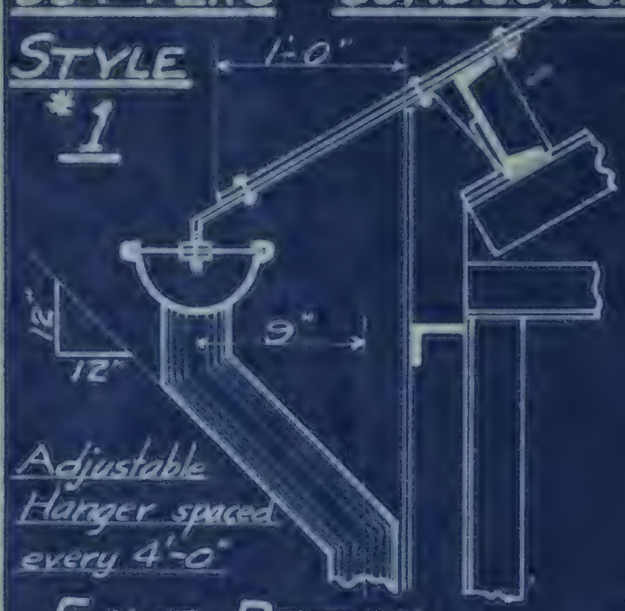
MILL BUILDING CONSTRUCTION

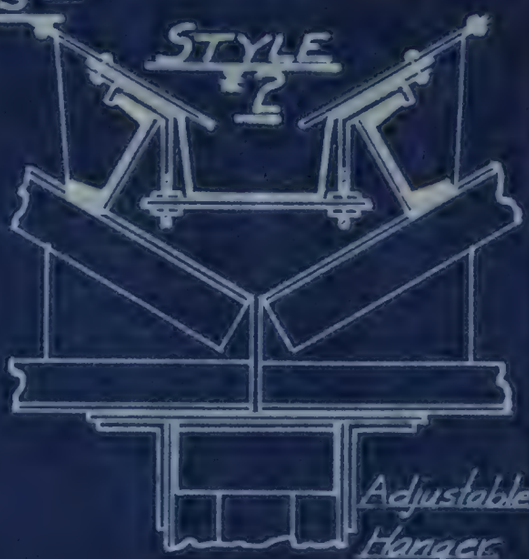
GUTTERS - CONDUCTORS -

STYLE *1



Adjustable Hanger spaced every 4'-0"

STYLE *2



Adjustable Hanger spaced every 3'-0"

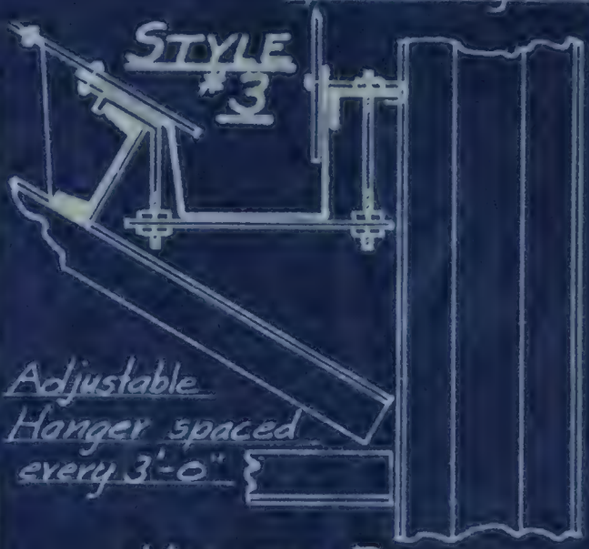
EAVE DETAIL

Style	Area Drained Sq. Ft.	Size of Gutter	Conductors Diam.	Conductors Spaced
*1	1200	6"	4"	40'-0"
	1800	7"	5"	40'-0"
	2400	8"	5"	40'-0"
*2	2400	4" x 8"	5"	40'-0"
*3	3600	5" x 8"	6"	40'-0"
	4800	5" x 10"	6"	40'-0"

COMMON SIZES OF CONDUCTORS

Round	2"	3"	4"	5"	6"
Equiv. Rectan.	1¾" x 2¼"	2¾" x 3¼"	2¾" x 4¼"	3¾" x 5"	

STYLE *3



Adjustable Hanger spaced every 3'-0"

VALLEY DETAILS

SLOPE - One Inch in 15'-0"

GAUGE - Eave and Valley Gutters are usually made of #20 gauge steel or same gauged steel as roofing. Conductors are usually made of #22 gauge steel or same gauged steel as siding.

END LAP - An End Lap of 4" is allowed for joints in all gutters. End Laps must be securely riveted and soldered in field.

GENERAL NOTES - Order gutters in 8'-0" lengths. Where practicable use standard sized sheets. When the girth of the metal is too large for a single sheet, specify two widths to be securely riveted and soldered with joint in bottom of gutter, running longitudinally. This joint must be made before gutter is placed in position on roof.

Gutters and Conductors, except for simple valley gutters, will be ordered from drawing. Drawings should give a cross section of the gutter showing attachments for supporting same, the location of the conductors, and whether the conductors are to be round, rectangular, plain, or corrugated and should give the size, section, length, and any bend or special provision required of the conductors. Corrugated Conductors are generally used.

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As Approved, 6-18-10

MILL BUILDING CONSTRUCTION
ANTI-CONDENSATION LINING - BERLIN SYSTEM

#19 Galv. Wire Netting 2" mesh
laced at edges with #20 brass wire
14# Asbestos
6# Asbestos
Neponset Bldg. Paper (2 thicknesses)
Corr. Steel

Anti-Condensation Lining consists of a layer of Wire Netting, #19 gauge galvanized wire and 2" mesh, placed on top of purlins transversely so that the edges are separated about 1½". These edges are then drawn together by #20 brass wire. On this netting is placed a layer of 14# Asbestos and then another layer 6# Asbestos. All holes in the Asbestos must be patched up when laid. Over this asbestos is then placed two thicknesses of Neponset Building Paper. The Asbestos and Building Papers should lap at least 3" and should break joints not less than 12". The Building Paper should never be left exposed. Cover the edges at eaves, gables, and all openings with Asbestos in order to have complete protection against fire.

Where purlins are spaced more than 4'-0" apart, a #9 galvanized wire is stretched across the purlins, at about 2'-0" C. to C., to prevent the wire netting from sagging.

When Bays are longer than 10'-0" the purlins are trussed to take up the pull due to the stretching of the wire netting. This applies to channel purlins. Where angle or "Z" bar purlins are used, the matter should be investigated.

The Lining is held in place by Clips and Bolts (1½" lg.) or Clinch Rivets, spaced as for ordinary Corr. Steel Covering, which are used to hold the Corr. Steel except at the eaves where Flat-head Bolts are used. Should the nut of the bolt come directly in contact with the Lining, a Tin Washer is used under the same to prevent breaking or tearing of the Lining.

WIRE NETTING comes in bundles of 900 Sq. Ft. (6'-0" wide by 150'-0" long). Do not cut bundles and make no allowance for laps.

#20 BRASS WIRE can be bought in any quantity. Order by the pound, allowing 272 Ft. to the pound.

#9 GALVANIZED WIRE can be bought in any quantity. Order by the pound, allowing about 17'-0" to the pound.

ASBESTOS is sold by the pound, 6# and 14# to the square (10' by 10'), in rolls 36" wide. Any quantity can be purchased. Add 10% to the net area for laps, etc.

NEPONSET BUILDING PAPER is sold by the roll 36" wide, in lengths 250 ft. and 500 ft. (750 sq. ft and 1500 sq. ft. respectively). Do not cut a roll. Add 10% to the net area for laps, etc.

TIN WASHERS or the so called Tin Roofing Caps can be obtained in any quantity (by the pound).

CLIPS AND BOLTS - see Sheet M9.122 a

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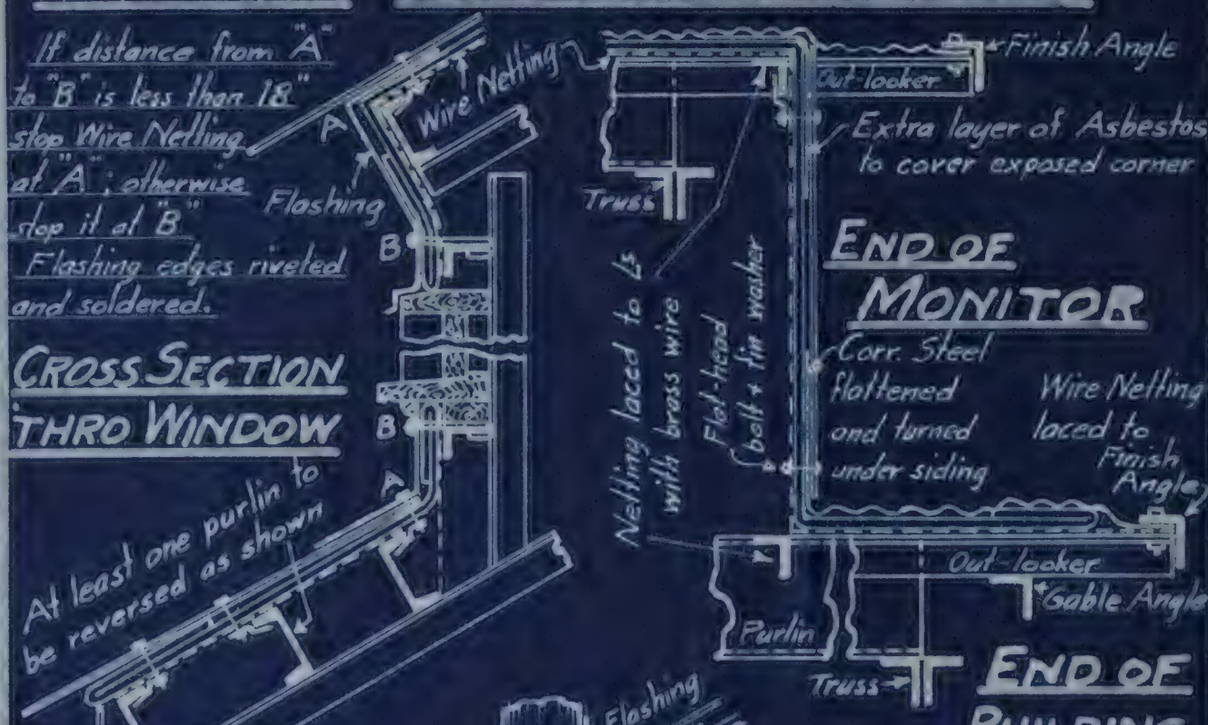
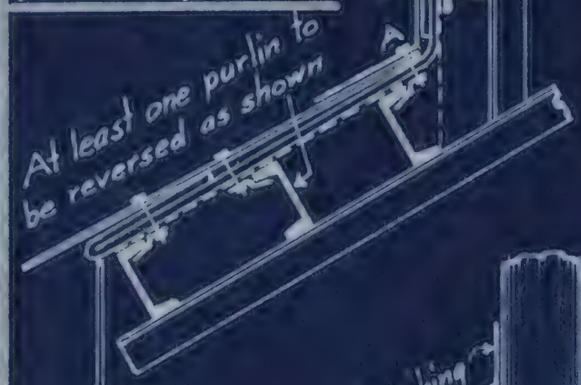
MILL BUILDING CONSTRUCTION

ROOF DETAILS - ANTI-CONDENSATION LINING

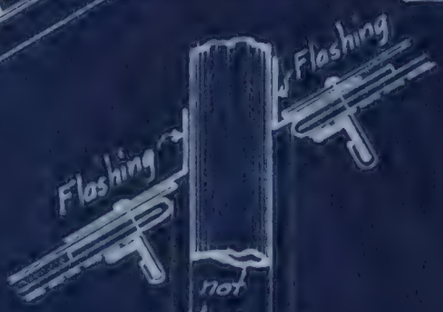


CROSS SECTION THRO WINDOW

END OF MONITOR

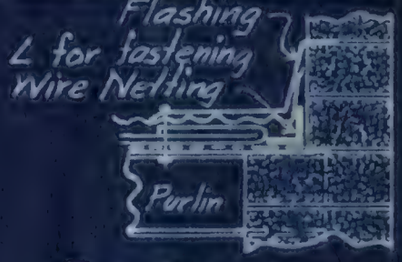


END OF BUILDING LONG. SECT.

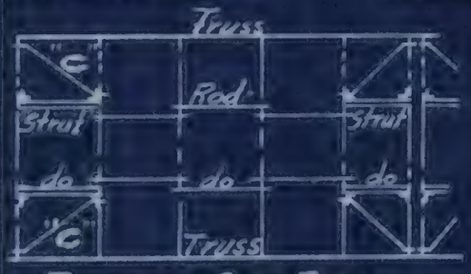


Use ¾" Rod Struts when purlin spacing is under 4'-0". Use L Struts for spacing 4'-0" or over.

STACK DETAIL

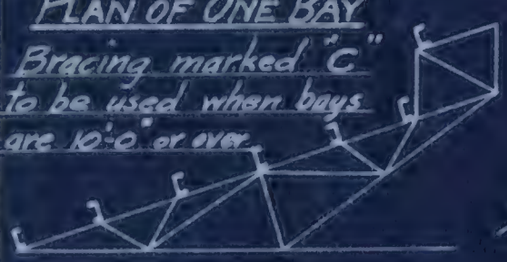


END WALL DETAIL



PLAN OF ONE BAY

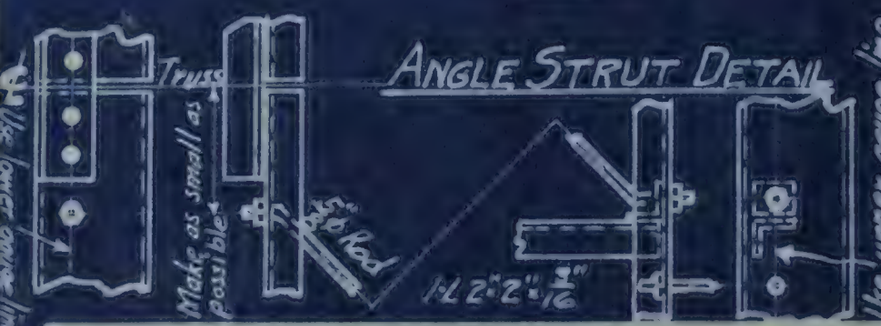
Bracing marked "C" to be used when bays are 10'-0" or over.



PLAN OF ONE BAY

DETAIL AT "R"

ROD STRUT DETAIL



ANGLE STRUT DETAIL

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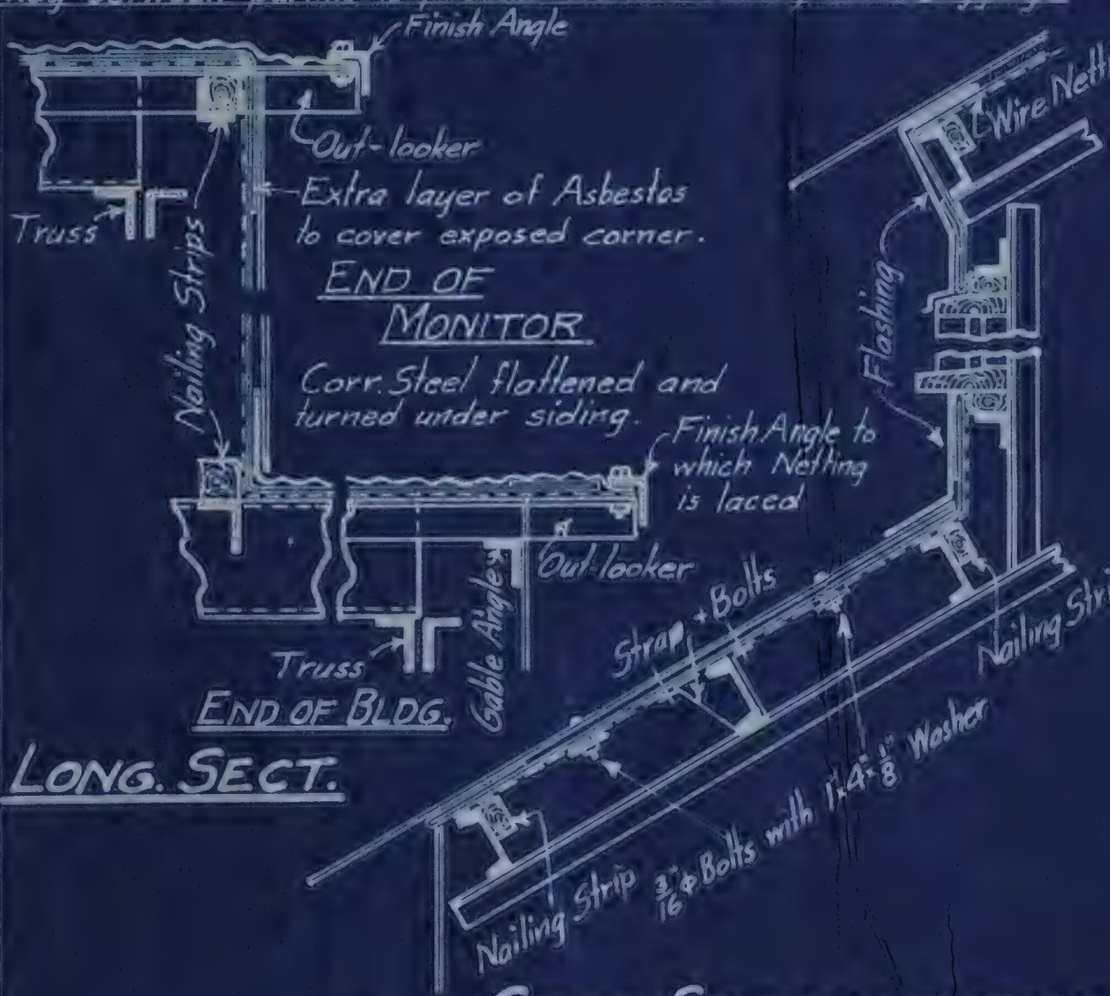
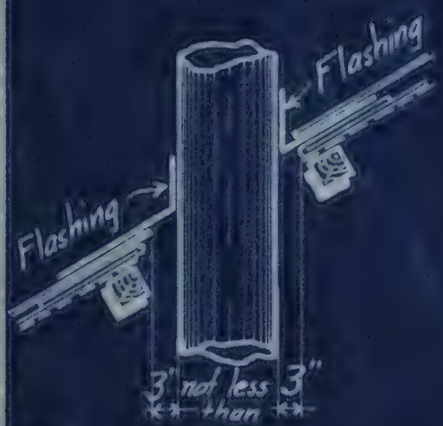
M9.127 a

ANTI-CONDENSATION FIRE PROOF LINING
MINNEAPOLIS SYSTEM (WESTERN) - M.B. CONST.

The Minneapolis System consists of a layer of #19 Galv. Wire Netting 2" Mesh, laid transversely to the purlins, allowing one inch side lap and fastened with 3/4" lg. wire staples to nailing strips at the eaves, ridge, ventilators, openings, etc.; a layer of 30# Asbestos Paper laid over the Wire Netting, allowing a 3" side lap and fastened to nailing strips to keep in place until corr. steel is laid - all holes in the Asbestos being patched up; and the Corrugated Steel laid over the Asbestos Paper and fastened to the purlins by Straps and Bolts and to the nailing strips by Corr. Steel Nails. A line of 3/16"ϕ Bolts with 1"x4"x1/8" Washers, spaced at about 2'-0" C. to C. is placed mid-way between purlins to prevent the Wire Netting from sagging.





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Mill Building Construction
Steel Shutters

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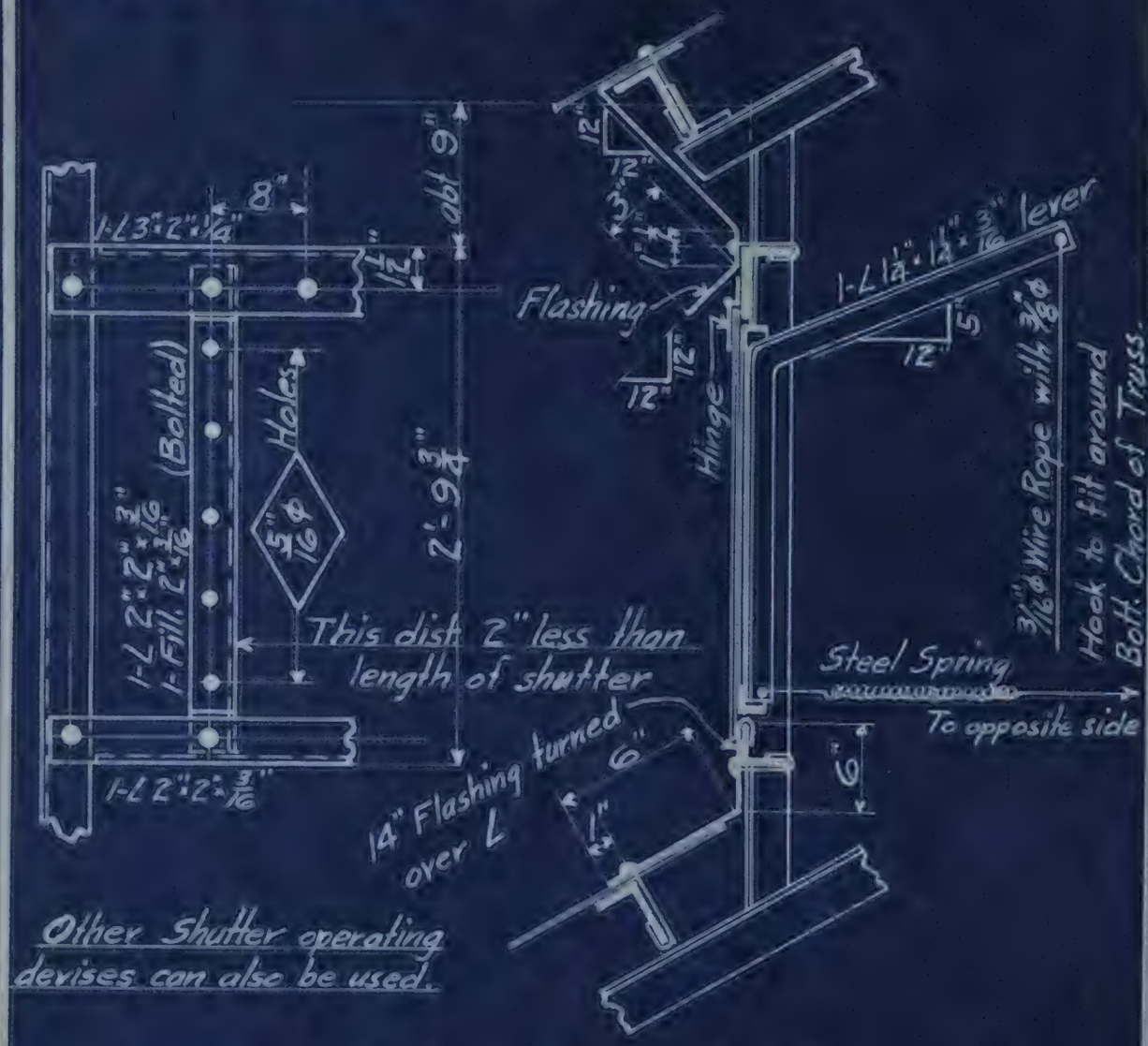
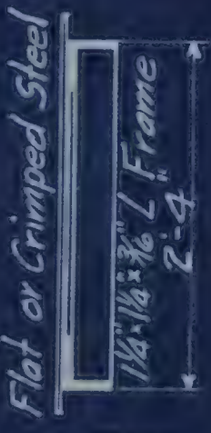
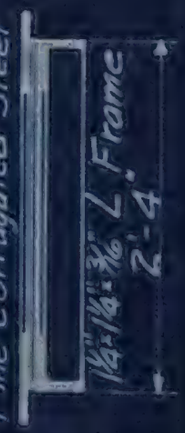




Ordinary length of shutter is 8'-0"
Shutters are made from 6'-0" to 10'-0" long - all being Standard width.
Use two Hinges for shutters 8'-0" long and under; three Hinges for shutters over 8'-0" long.



SECT. OF SHUTTER
FLAT OR CRIMPED STEEL

SECT. OF SHUTTER
CORRUGATED STEEL

Flat or Crimped Steel: #18 gauge and of same kind of materia as roof unless noted.

Monitors with Flat or Crimped Steel Shutters or with Corrugated Steel Shutters should have intermediate portions and ends covered with Corr. Steel the same as for the rest of the bldg.

Use Std. Corner Cap.

M9.1211 a

PIVOTED WINDOW - MILL BLDG. CONST.

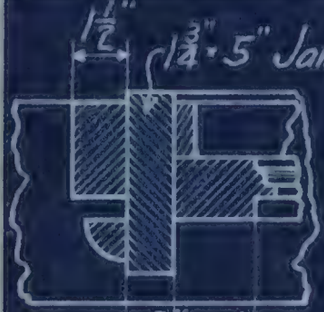
This Style Sash can be fixed or pivoted, can be used in windows in the sides or the clerestory.

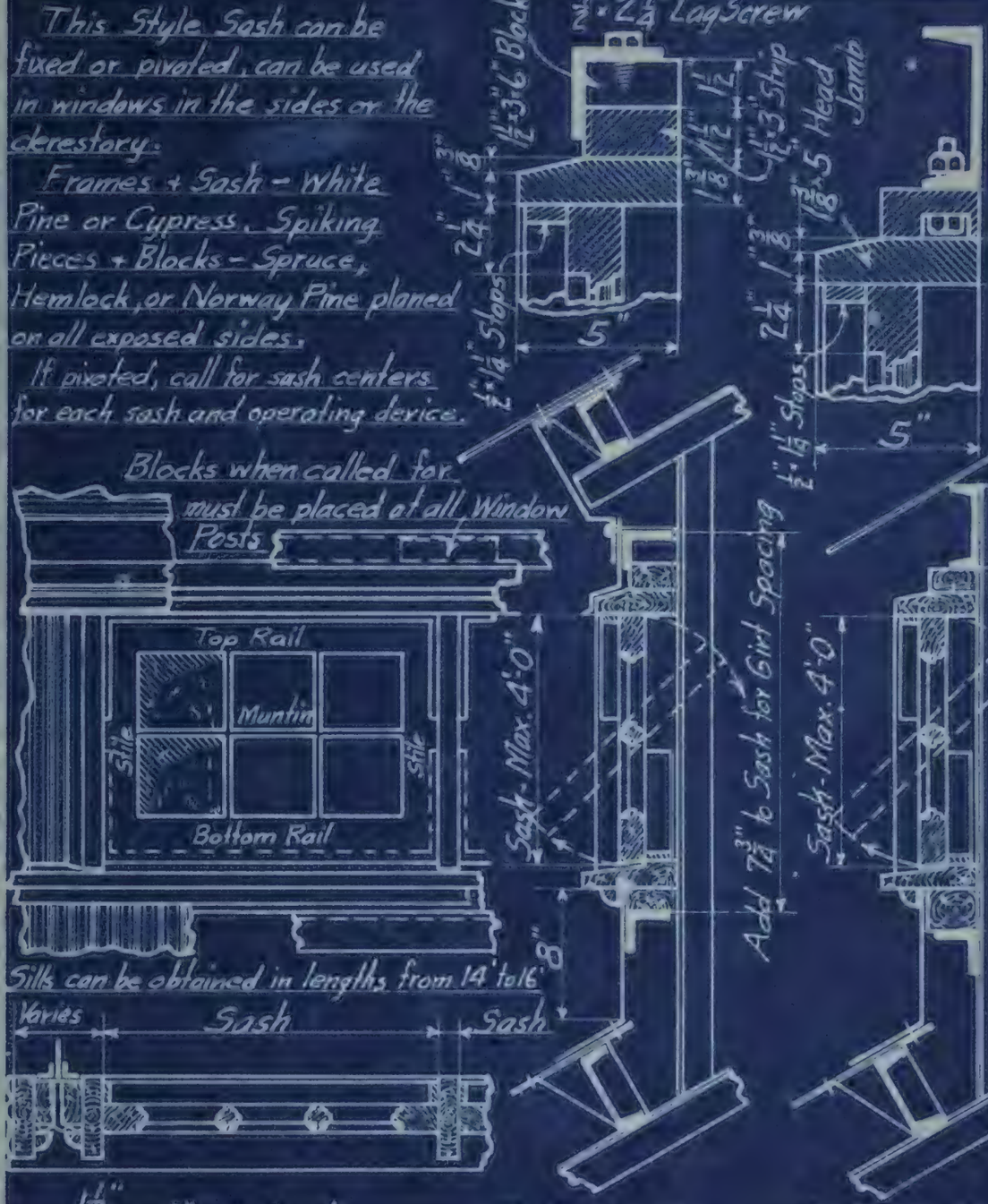
Frames + Sash - White Pine or Cypress. Spiking Pieces + Blocks - Spruce, Hemlock, or Norway Pine planed on all exposed sides.

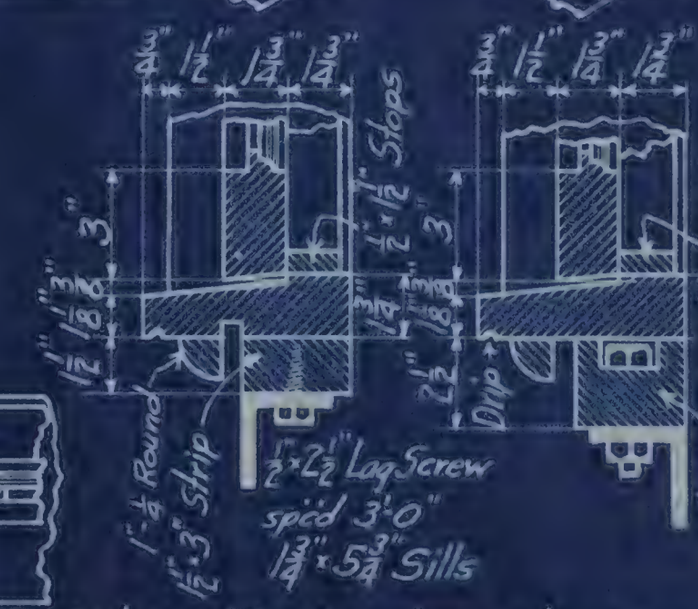
If pivoted, call for sash centers for each sash and operating device.

Blocks when called for must be placed at all Window Posts

Sills can be obtained in lengths from 14' to 16'







If Sash are Fixed, continue stops all around inside and out except across sill on the outside.

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A.B.Co's Standard

As Approved: 6-14-07

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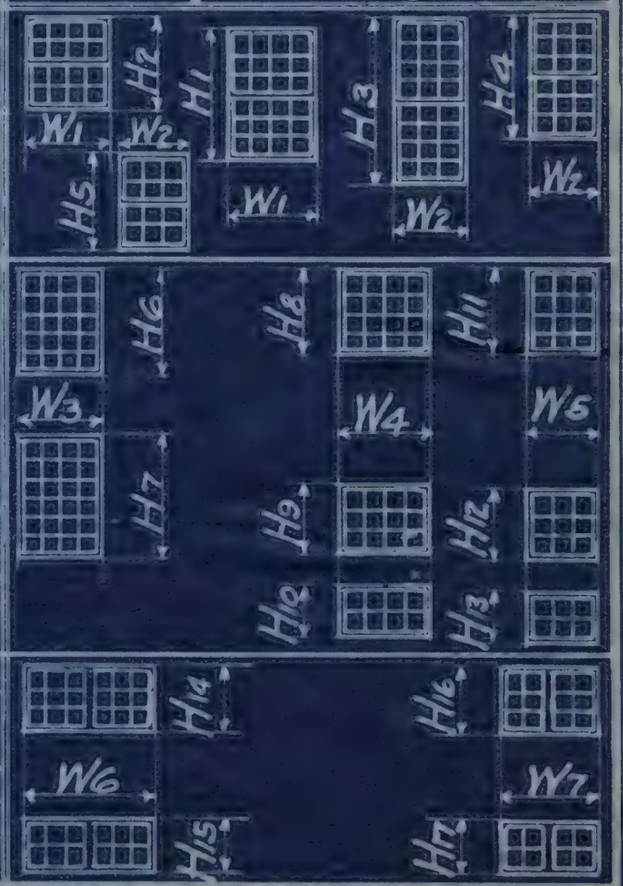
DIMENSIONS FOR GLASED WOOD SASH – MILL BUILDING CONSTRUCTION

All Stiles, 2¼" wide; Top Rails, 2½"; Bottom Rails, 3". Muntins, ⅞" wide except Horizontally Pivoted Sash, 4 lights high or over, and all other Sash, 6 lights high or over, which are to have one Hor. Muntin, 1⅛" wide and Vertically Pivoted Sash, 4 lights wide or over and all other Sash, 6 lights wide or over which are to have one Vert. Muntin 1½" wide. All Sliding, Pivoted, Single, + ½ Double Hung Sash, 4'-6" high by 4'-0" wide, or under, to be 1⅜" thick; all others to be 1¾" thick. For Pivoted Sash, 4 + 5 lights high or wide, add 1⅛" to figures given in Tables.

Glass / Sash	Quality of Glass		"B" American Single Strength				"B" Am. Double Strength			No. of Lights + Style of Sash
	Size of Glass		10"×12"	12"×12"	10"×14"	12"×14"	10"×16"	12"×16"	14"×16"	
Double Hung Sash	Width	W 1	3'-9 5/8"	4'-5 5/8"	3'-9 5/8"	4'-5 5/8"	3'-9 5/8"	4'-5 5/8"	5'-1 5/8"	
	Height	H 1	6-8 1/4	6-8 1/4	7-8 1/4	7-8 1/4	8-8 1/4	8-8 1/4	8-8 1/4	
		H 2	4-7 1/2	4-7 1/2	5-3 1/2	5-3 1/2	5-11 1/2	5-11 1/2	5-11 1/2	
	Width	W 2	2-11 1/4	3-5 1/4	2-11 1/4	3-5 1/4	2-11 1/4	3-5 1/4	3-11 1/4	
	Height	H 3	8-9	8-9	10-1	10-1	11-5	11-5	11-5	
		H 4	6-8 1/4	6-8 1/4	7-8 1/4	7-8 1/4	8-8 1/4	8-8 1/4	8-8 1/4	
		H 5	4-7 1/2	4-7 1/2	5-3 1/2	5-3 1/2	5-11 1/2	5-11 1/2	5-11 1/2	
Single Sash	Width	W 3	3-9 5/8"	4-5 5/8"	3-9 5/8"	4-5 5/8"	3-9 5/8"	4-5 5/8"	5-1 5/8"	
	Height	H 6	5-6 3/4"	5-6 3/4"	6-4 3/4"	6-4 3/4"	7-2 3/4"	7-2 3/4"	7-2 3/4"	
		H 7	6-8 1/4	6-8 1/4	7-8 1/4	7-8 1/4	8-8 1/4	8-8 1/4	8-8 1/4	
	Width	W 4	3-9 5/8"	4-5 5/8"	3-9 5/8"	4-5 5/8"	3-9 5/8"	4-5 5/8"	5-1 5/8"	
	Height	H 8	4-6 3/8"	4-6 3/8"	5-2 3/8"	5-2 3/8"	5-10 3/8"	5-10 3/8"	5-10 3/8"	
		H 9	3-6	3-6	4-0	4-0	4-6	4-6	4-6	
		H 10	2-5 5/8"	2-5 5/8"	2-9 5/8"	2-9 5/8"	3-1 5/8"	3-1 5/8"	3-1 5/8"	
	Width	W 5	2-11 1/4	3-5 1/4	2-11 1/4	3-5 1/4	2-11 1/4	3-5 1/4	3-11 1/4	
	Height	H 11	4-6 3/8"	4-6 3/8"	5-2 3/8"	5-2 3/8"	5-10 3/8"	5-10 3/8"	5-10 3/8"	
		H 12	3-6	3-6	4-0	4-0	4-6	4-6	4-6	
		H 13	2-5 5/8"	2-5 5/8"	2-9 5/8"	2-9 5/8"	3-1 5/8"	3-1 5/8"	3-1 5/8"	
Sliding Sash	Width	W 6	5-8 1/4	6-8 1/4	5-8 1/4	6-8 1/4	5-8 1/4	6-8 1/4	7-8 1/4	
	Height	H 14	3-6	3-6	4-0	4-0	4-6	4-6	4-6	
		H 15	2-5 5/8"	2-5 5/8"	2-9 5/8"	2-9 5/8"	3-1 5/8"	3-1 5/8"	3-1 5/8"	
	Width	W 7	3-11 1/2	4-7 1/2	3-11 1/2	4-7 1/2	3-11 1/2	4-7 1/2	5-3 1/2	
	Height	H 16	3-6	3-6	4-0	4-0	4-6	4-6	4-6	
		H 17	2-5 5/8"	2-5 5/8"	2-9 5/8"	2-9 5/8"	3-1 5/8"	3-1 5/8"	3-1 5/8"	

M9.1214 a

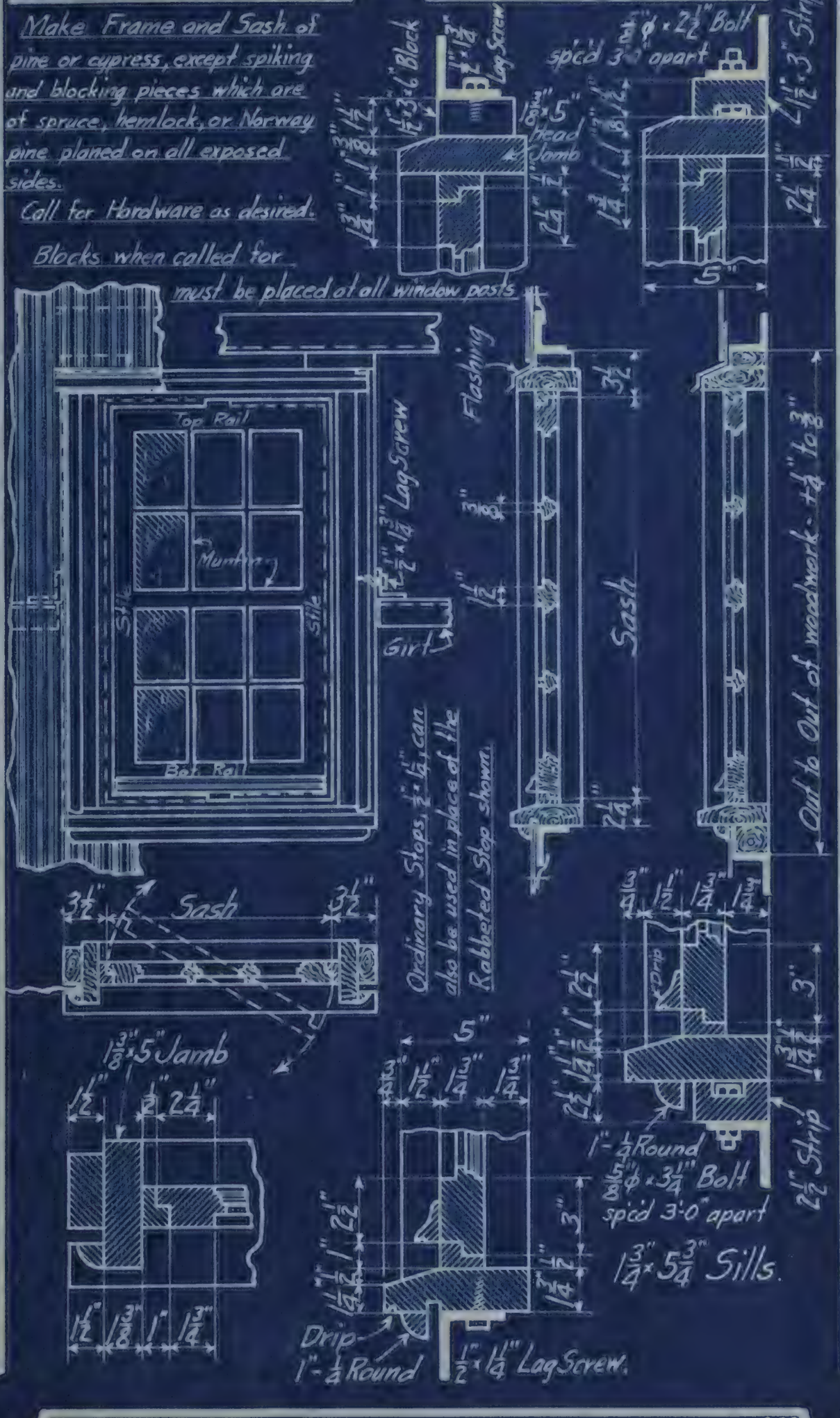
M9.1215 a

PIVOTED WINDOW — MILL BLDG. CONST.

Make Frame and Sash of pine or cypress, except spiking and blocking pieces which are of spruce, hemlock, or Norway pine planed on all exposed sides.

Call for Hardware as desired.

Blocks when called for must be placed at all window posts



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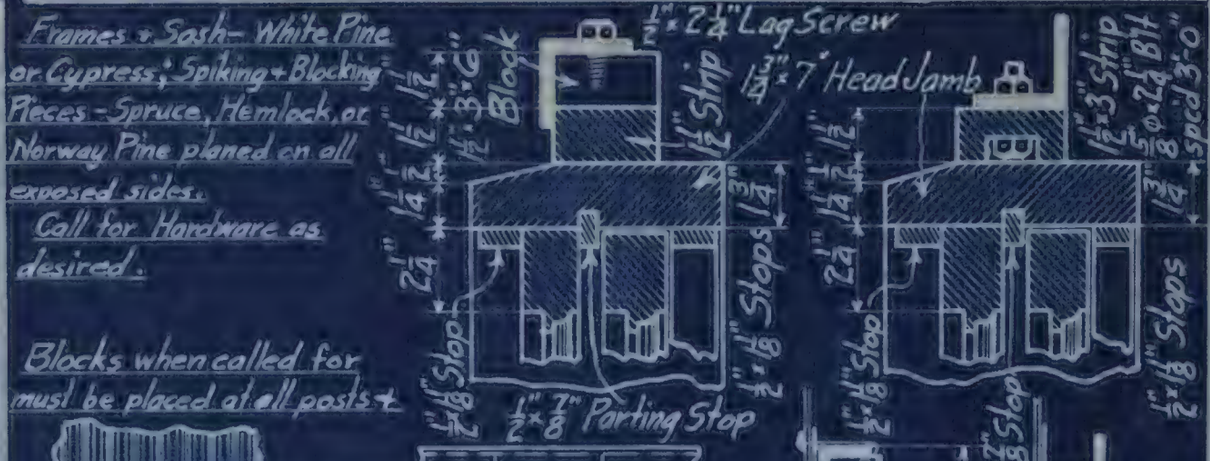
M9.1216 a

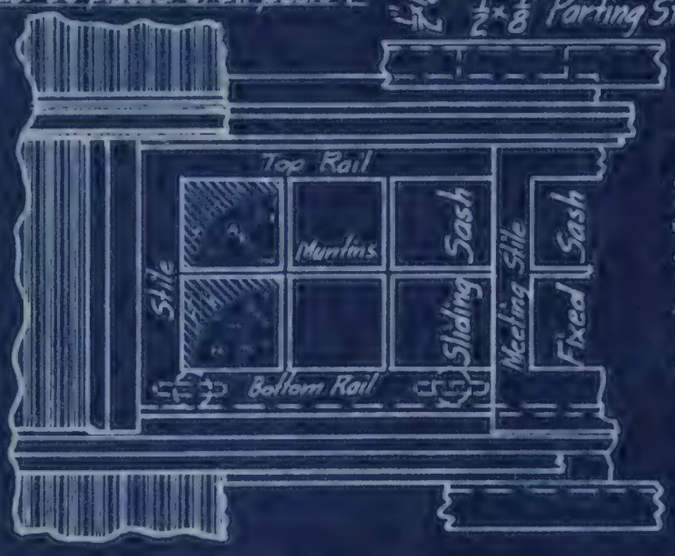
CONTINUOUS SLIDING SASH - M. BLDG. CONS.

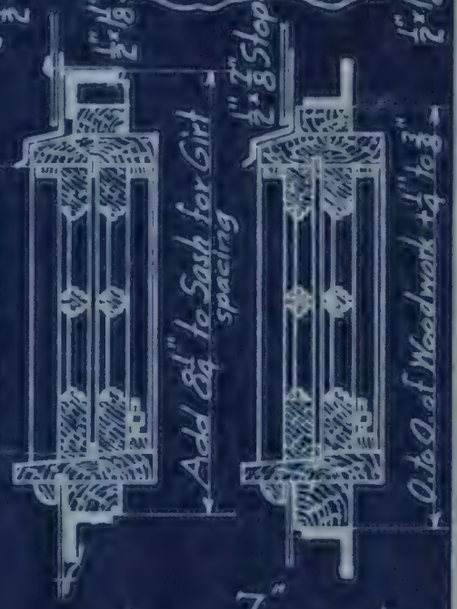
Frames + Sash - White Pine or Cypress; Spiking + Blocking Pieces - Spruce, Hemlock, or Norway Pine planed on all exposed sides.

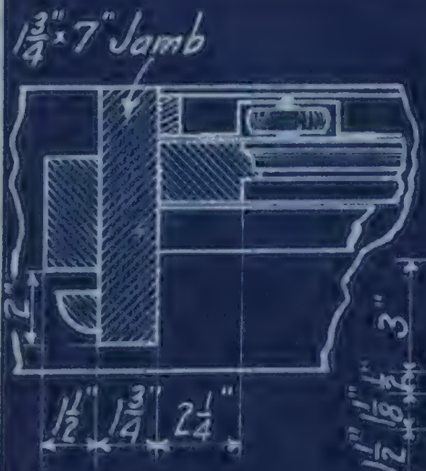
Call for Hardware as desired.

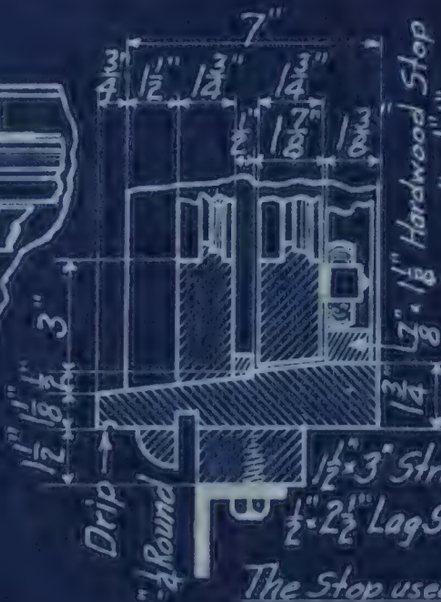
Blocks when called for must be placed at all posts +











1/2" x 1/2" Parting Stops.

1 3/4" x 7 3/4" Sills

The Stop used for Roller Track to be of Hardwood.

Sills can be obtained in lengths from 14' to 16'.

5-26-11

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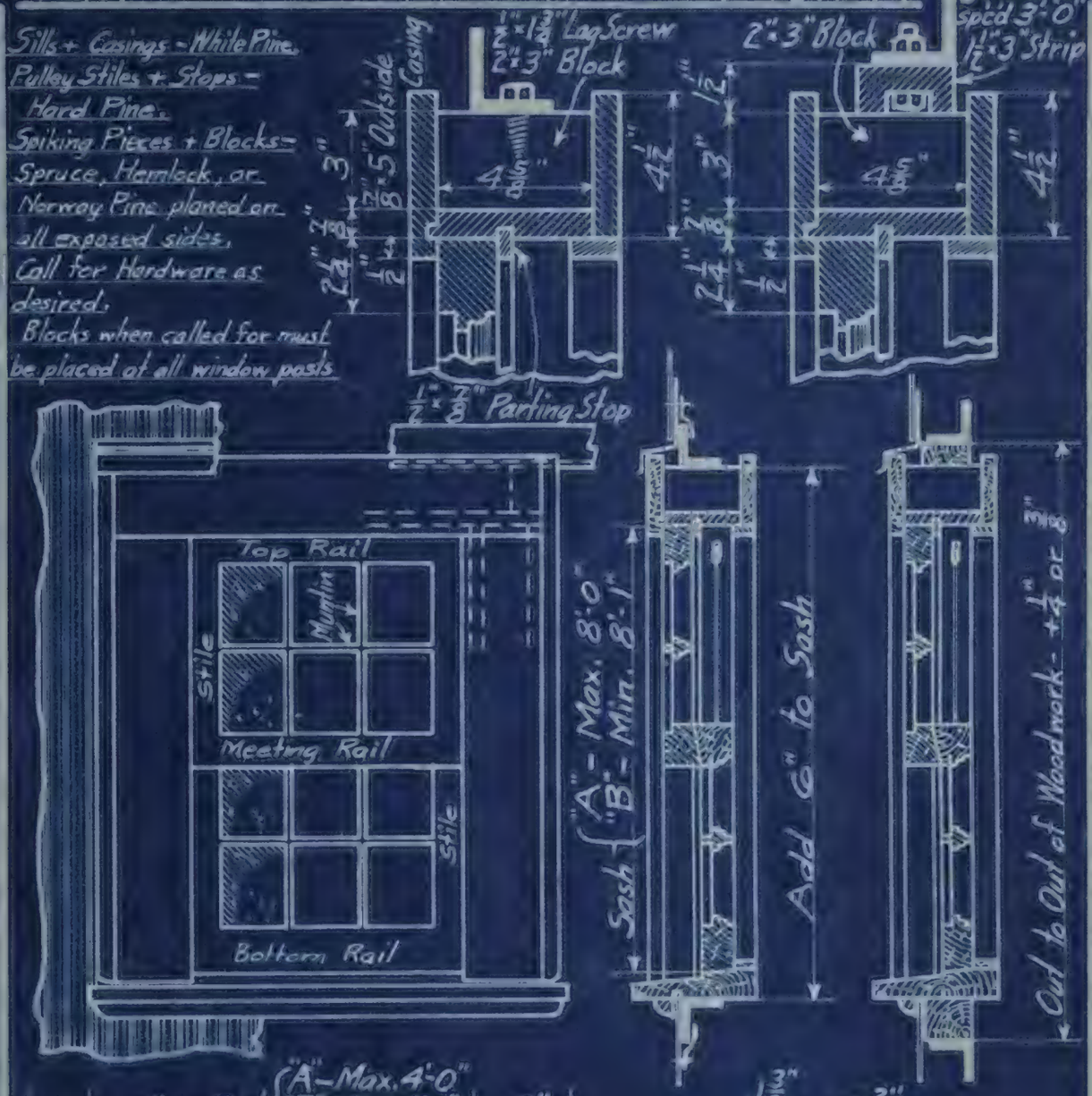
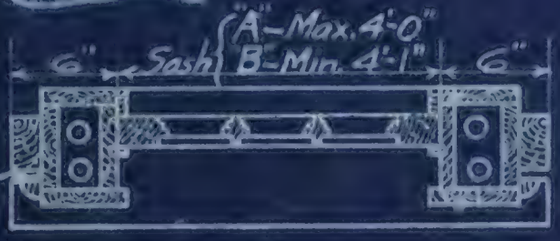
M9.1217 a

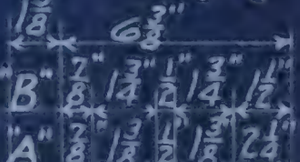
WEIGHTED SASH WINDOW – M. BLDG. CONST.

Sills + Casings – White Pine.
Pulley Stiles + Stops –
Hard Pine.
Spiking Pieces + Blocks –
Spruce, Hemlock, or
Norway Pine planed on
all exposed sides.
Call for Hardware as
desired.
Blocks when called for must
be placed at all window posts

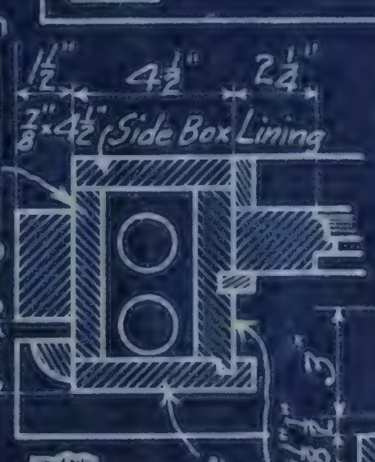


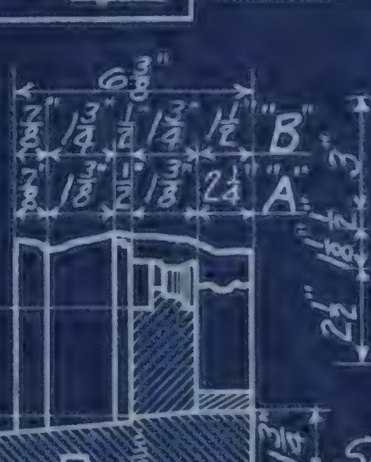


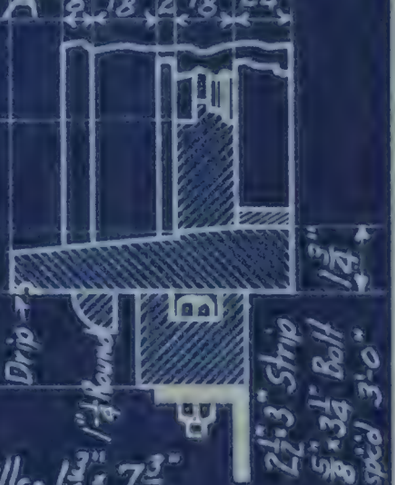
For Sash "B"



" " "A"







Use 1/2" × 2 1/4" Stops for Sash "A" (4'-0" × 8'-0" Max. – 1 3/8" thick)

Use 1/2" × 1 1/2" Stops for Sash "B" (4'-1" × 8'-1" Min. – 1/4" thick)

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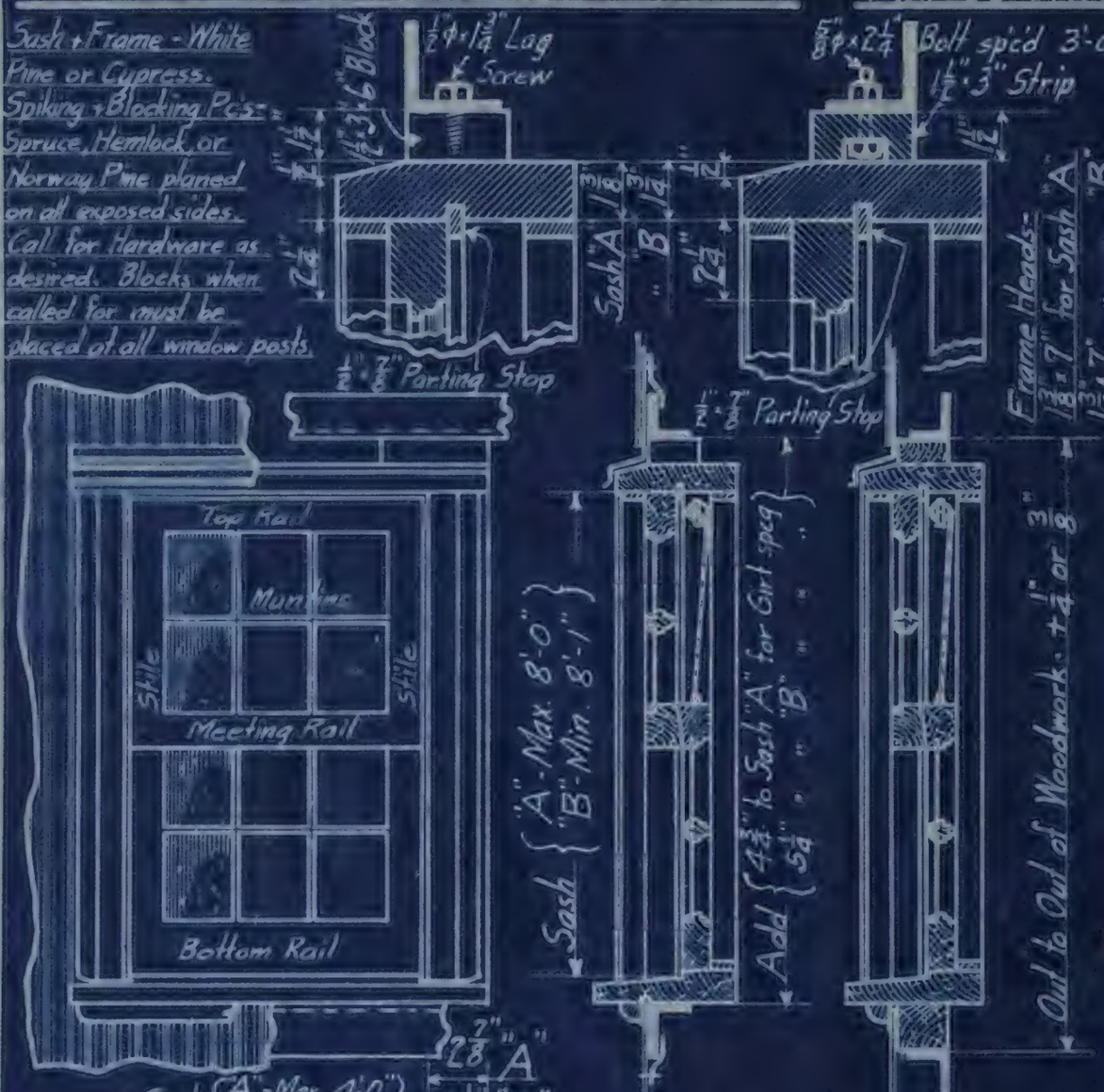
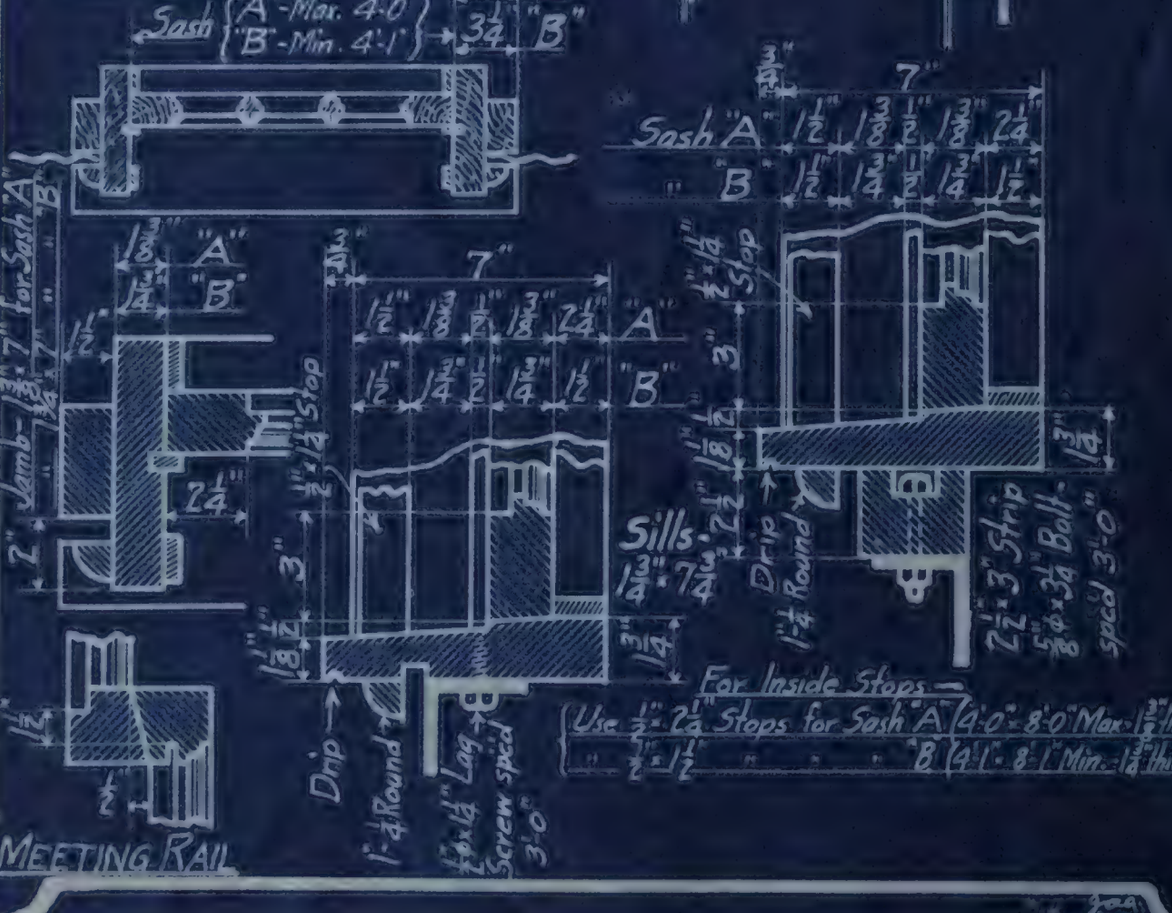
M9.1218 a

COUNTER-BALANCED WINDOW — M. Bldg. Const.

Sash + Frame - White Pine or Cypress.
Spiking + Blocking Pcs - Spruce, Hemlock or Norway Pine planed on all exposed sides.
Call for Hardware as desired. Blocks when called for must be placed at all window posts.


1/2" Ø x 1 3/4" Lag Screw
5/8" Ø x 2 1/4" Bolt spc'd 3'-0"
1 1/2" x 3" Strip
3" Block
1/2" x 7/8" Parting Stop
Sash "A" 1 3/8"
" "B" 1 1/4"
2 1/4"
Frame Heads - 1 3/8" x 7" for Sash "A"
1 1/4" x 7" " " "B"
Top Rail
Muntins
Stile
Stile
Meeting Rail
Bottom Rail
Sash { "A" - Max. 8'-0" / "B" - Min. 8'-1" }
Add { 4 3/4" to Sash "A" for Girt spcg / 5 1/4" " " "B" " " }
Out to Out of Woodwork, +1" or 3"


2 7/8" "A"
Sash { "A" - Max. 4'-0" / "B" - Min. 4'-1" } 3 1/4" "B"
Sash "A" 1 1/2" 1 3/8" 1/2" 1 3/8" 2 1/4"
" "B" 1 1/2" 1 3/4" 1/2" 1 3/4" 1 1/2"
1 3/8" "A"
1 1/4" "B"
1 1/2"
Jamb - 1 3/8" x 7" for Sash "A"
" 1 1/4" x 7" " " "B"
2 1/4"
2" Stop
3"
1 1/2" x 1 1/4" Stop
Sills 1 3/4" x 7 1/4"
Drip
1 1/4" Round
2 1/2" x 3" Strip
5/8" Ø x 3 1/4" Bolt spcd 3'-0"
For Inside Stops —
Use 1/2" x 2 1/4" Stops for Sash "A" 4'-0" - 8'-0" Max. 1 3/8" thick
" 1/2" x 1 1/2" " " " "B" 4'-1" - 8'-1" Min. 1 1/4" thick
1/2"
Drip
1 1/4" Round
1/2" x 1/4" Lag Screw spcd 3'-0"
MEETING RAIL

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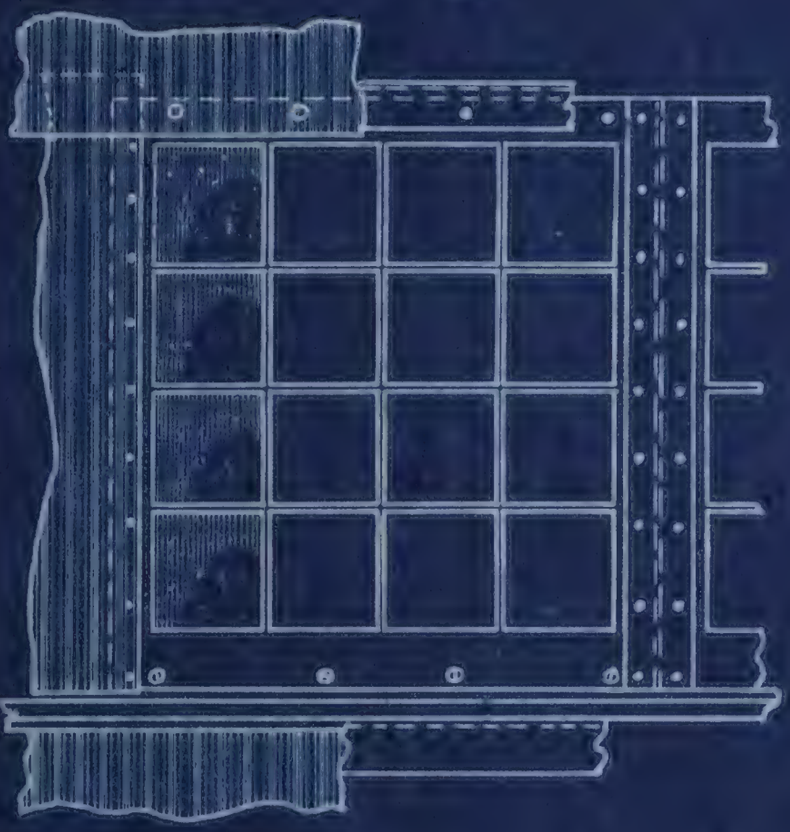
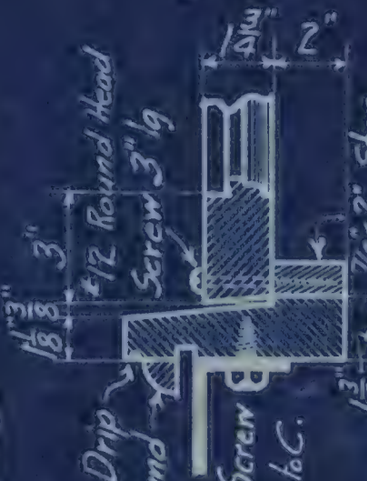
M9.1219 a

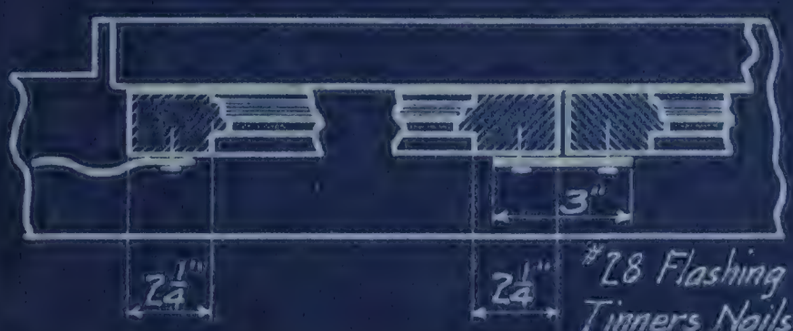
CONTINUOUS FIXED SASH - MILL BLDG. CONST.

Make Sash and Sill of White Pine or Cypress, planed on all exposed sides.

Sills can be obtained in lengths from 14'-0" to 16'-0"







#28 Flashing Tinners Nails spcd 6" C. to C.

1¾" × 5¾" Sill

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M9.1221 a

CRIMPED STEEL SHUTTER – M. BLDG. CONST.

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A.R.C.A. Standard
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LAP JOINT

2-2-½" L Stops are also used instead of the 2" 1⅜ × ¼" L Stops.

FRAME HEAD

BAR STAY

SILL

Use three Hinges for Shutters over 7'-0" high by over 5'-0" wide. Hinges to be located and riveted to shutters at bldg. Provide holes in hinges and jambs. Weld frame at corners when Bars are used; use Goose Plates when angles are used.

Height

Width

#16 or #18 Crimped Steel

4" Hole

4" Ring

Swivel Bar Knob

L-L 1⅜ × 1 × ¼ - 4½ lg.

Swivel Stay

¾" Rod

HALF PLAN WITH SWIVEL STAY

HALF PLAN WITH SHUTTER HOOK

Provide 4"ϕ Hole near locking device if reqd by Bd of Fire U.R.
Provide 4"ϕ Ring on inside of shutter if swivel bar is used.
Rivets ⅜"ϕ spcd 5" C. to C.
Use ⅜ϕ or ¼"ϕ stove bolts for stays.

¾ϕ Pin - 2¾ lg.
⅝ϕ Pin - 2¼ lg.

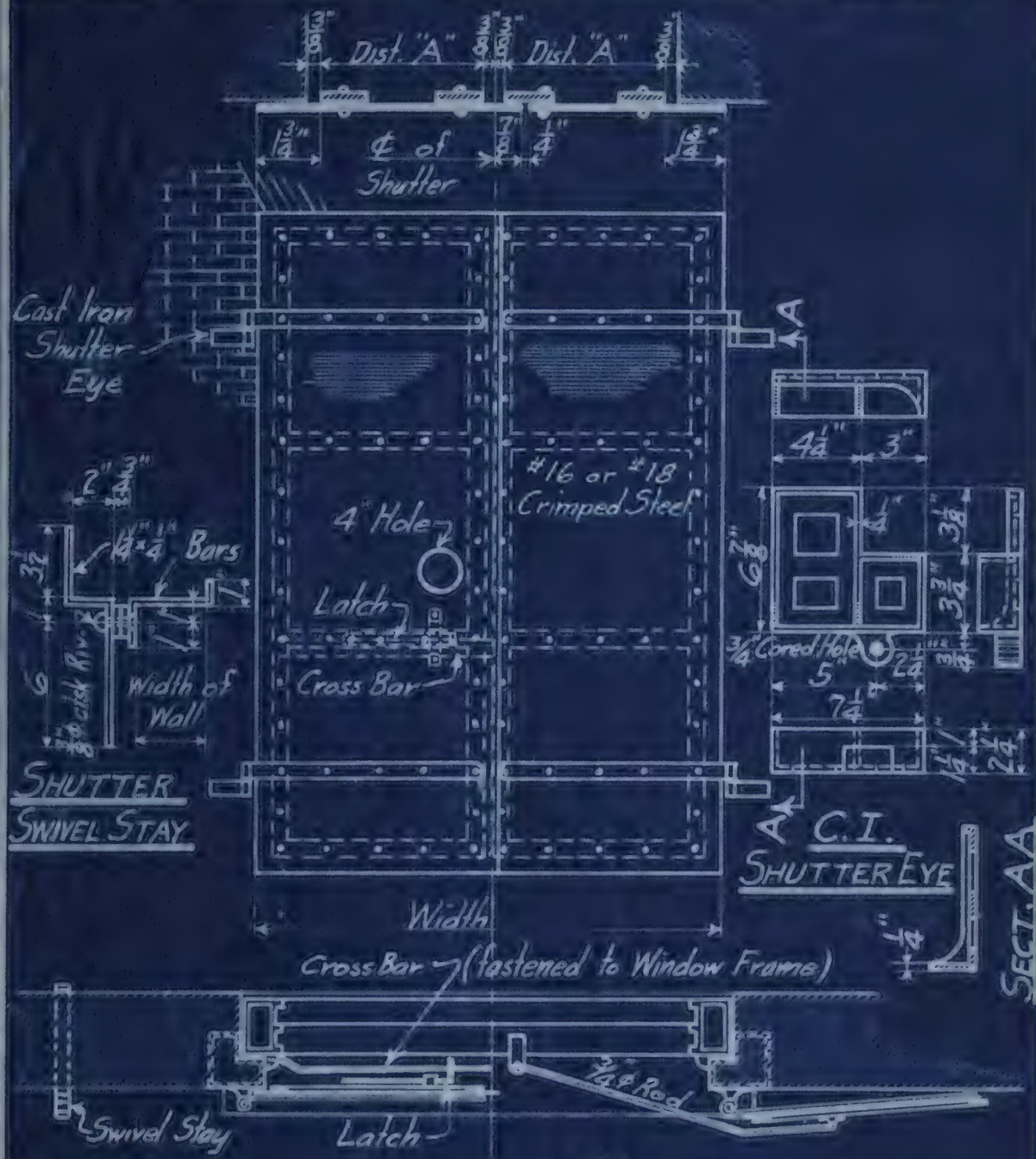
SHUTTER SWIVEL STAY

JAMB

Width	Height	No. Panels	Frame	Cross Bar	Hinge	Pin
Under 5'-0"	Under 7'-0"	3	1½" × ⅜" Bars	2 × ½	1½ × ⅜	⅝" ϕ
" "	Over 7'-0"	4	1½ × ½ Bars or 1½ × 1½ × 7/16 L	do	do	do
Btn. 5'-0" + 6'-0"	Under 7'-0"	3	1½ × ½ " " 1½ × 1½ × ⅜ L	2-2" L	2 × ⅜	do
" " " "	Over 7'-0"	4	1¾ × ½ " " 1¾ × 1¾ × ⅜ L	do	do	¾ ϕ
" 7'-0" + 8'-0"	Btn. 9'-0" & 12'-0"	5	2" × ½ " " 2" × 2 × ¼ L	do	do	do

M 9.1222 a

CRIMPED STEEL SHUTTERS - FOR BRICK BLDGS.



HALF PLAN WITH CROSS BAR AND LATCH

HALF PLAN WITH SHUTTER HOOK

Use three Hinges for shutters over 7'-0" high by over 5'-0" wide. Hinges to be located and riveted to shutters at bldg. Shutter Eyes to be built in the masonry.

Weld frame at corners when Bars are used; use Goose Plates when angles are used. Rivets - ⅜" diam. spaced at about 5" on centers.

Provide 4" diam. Hole near locking device if required by Bd of Fire Underwriters.

Provide 4" diam. Ring on inside of shutter if Swivel Bar is used.

Width	Height	No. Panels	Frame	Cross Bar	Hinges	Pin
Under 5'-0"	Under 7'-0"	3	½" × ⅜" Bars	2" × ½"	½" × ⅜"	⅝" ϕ
" 5'-0"	Over 7'-0"	4	1½" × ½" Bars or 1½" × 1½" × 3/16" ℓs	do	do	do
Bfn. 5'-0" + 6'-0"	Under 7'-0"	3	do	do	2" × 2" ℓ	2" × ⅜"	do
5'-0" + 6'-0"	Over 7'-0"	4	1¾" × ½" Bars or 1¾" × 1¾" × ¼" ℓs	do	do	¾" ϕ
7'-0" + 8'-0"	Bfn. 9'-0" + 12'-0"	5	2" × ½" Bars or 2" × 2" × ¼" ℓs	do	do	do

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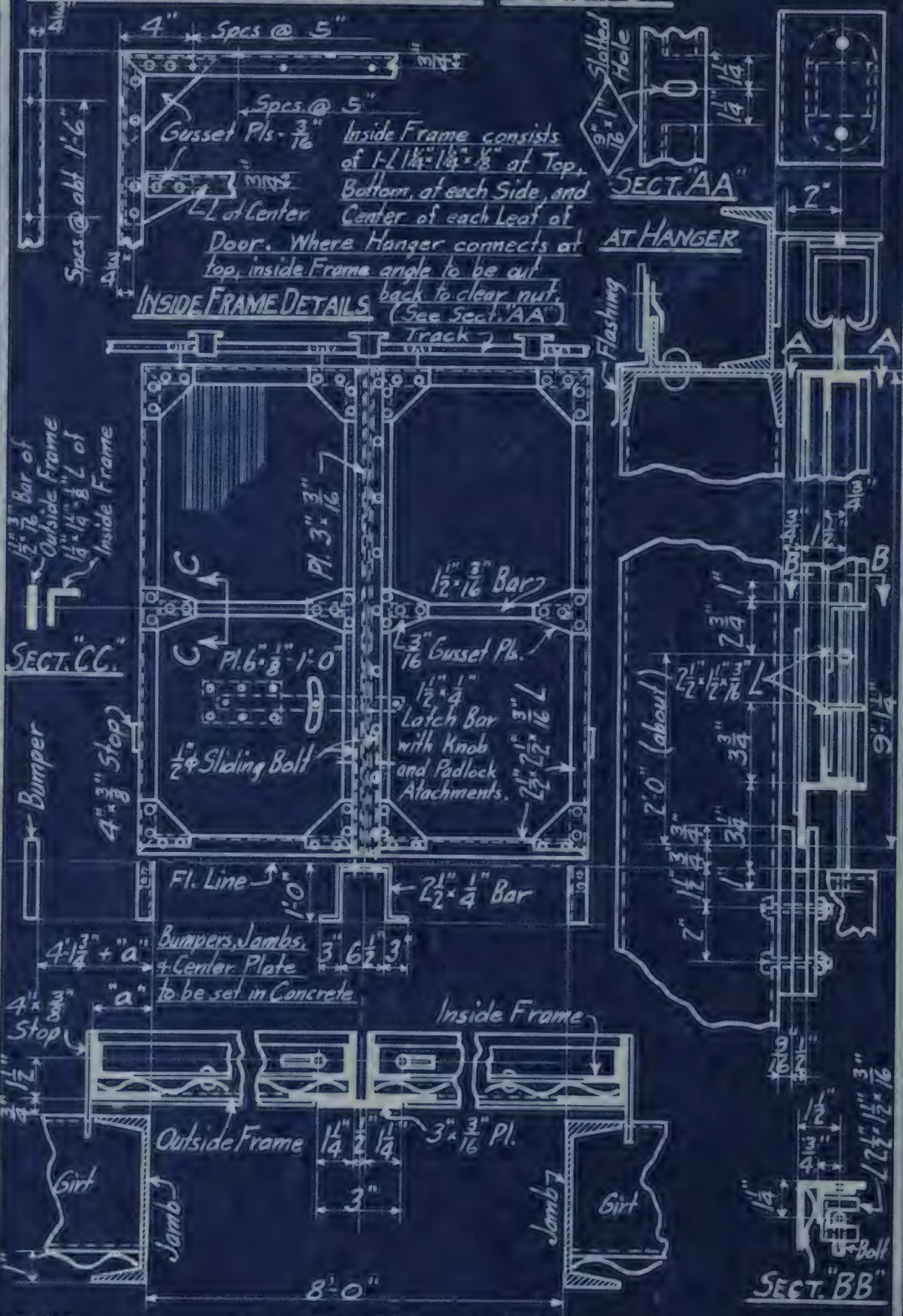
M9.1225 a

CORRUGATED STEEL DOOR - SLIDING.



Outside Frame consists of 2½"-2½"-3/16" Ls and 1½"-3/16" Bars.

Corrugated Steel to be same gauge as siding and is to be riveted in field to top and bottom angles of inside frame.

RIVETS - For Inside Frame, #5 Wire; For Outside Frame, ½" ϕ. OPEN HOLES - For #5 Wire.

Inside Frame to be shipped bolted in place. If desired to cheapen construction of Door, omit side and center angles of inside frame.

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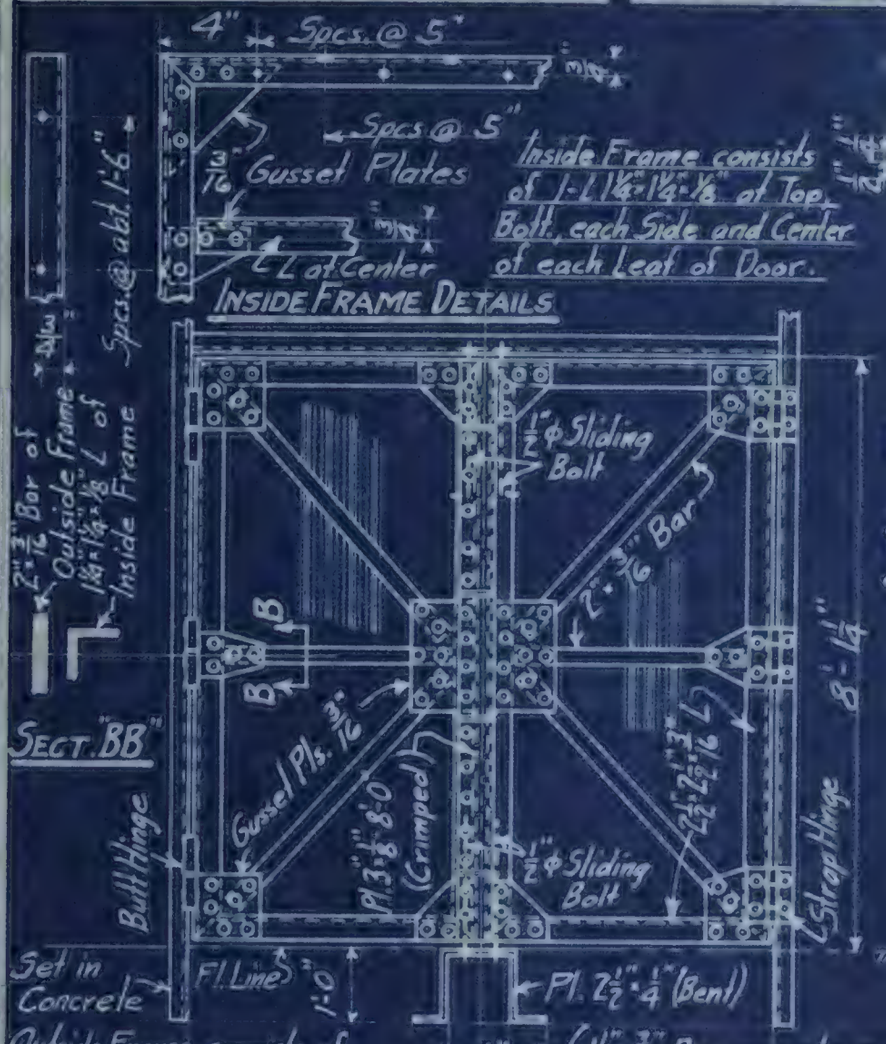
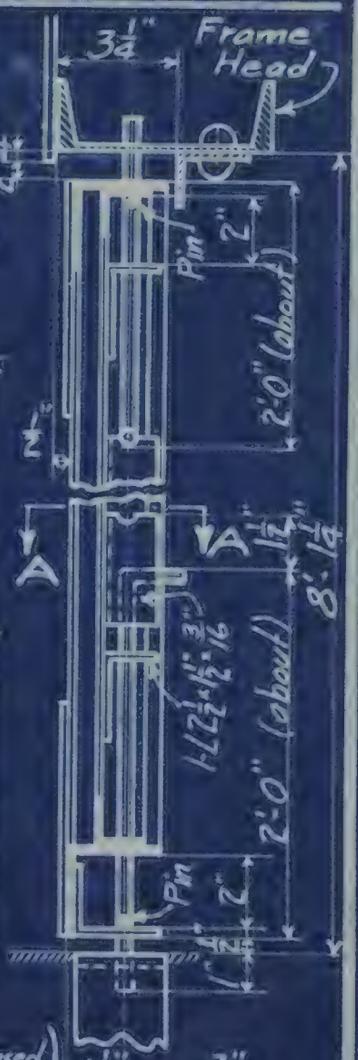
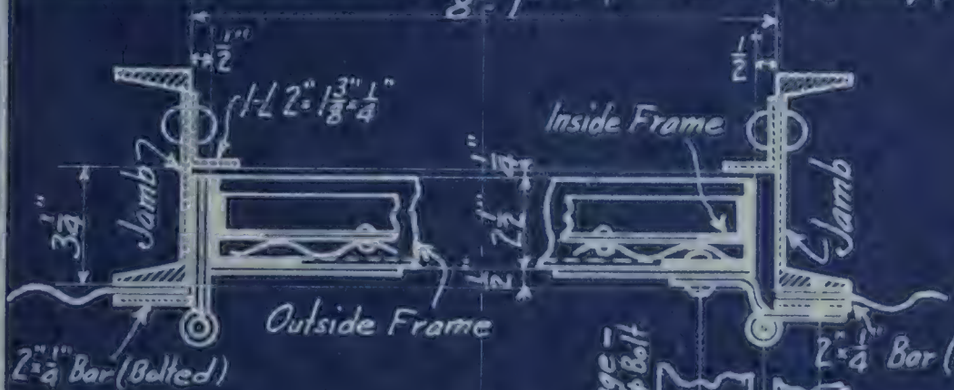
M9.1227 a

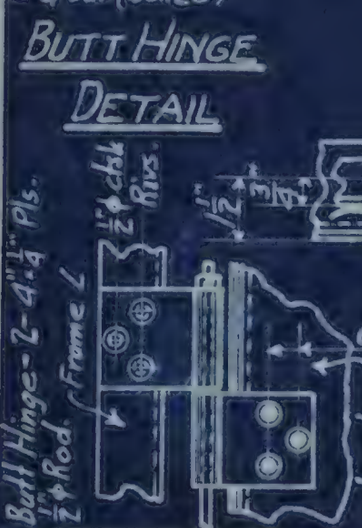
CORRUGATED STEEL DOOR - HINGED - SWINGING OUT -


4" = Spcs. @ 5"
Spcs @ 5"
3/16" Gusset Plates
L L at Center
Inside Frame consists of 1-L 1¼"·1¼"·⅛" at Top, Bolt, each Side and Center of each Leaf of Door.
INSIDE FRAME DETAILS
2"·3/16" Bar of Outside Frame
1½"·1½"·⅛" L of Inside Frame
Spcs @ abt 1'-6"
½"φ Sliding Bolt
2"·3/16" Bar
SECT. "BB"
Butt Hinge
Gusset Pls. 3/16"
Pl 3½"·8'-0" (Crimped)
2½"·2½"·3/16" L
Strap Hinge
8'-1¼"
Set in Concrete
Fl. Line
1'-0"
Pl. 2½"·¼" (Bent)
Outside Frame consists of 2½"·2½"·3/16" Ls and 2"·3/16" Bars.
3" 6½" 3"
8'-1"
(1½"·3/16" Bars are also used in place of the 2"·3/16" Bars)

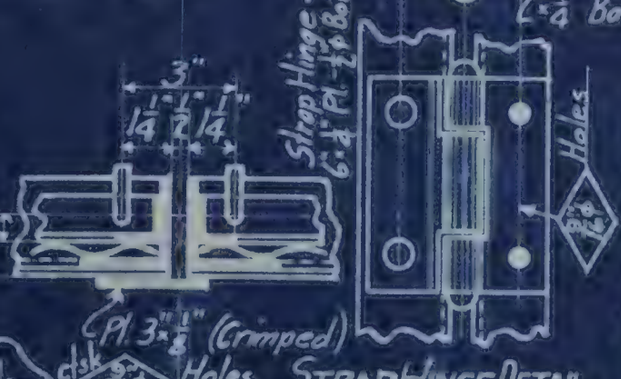




BUTT HINGE DETAIL



STRAP HINGE DETAIL



If desired to cheapen construction of door, omit side and center angles of inside frame. Holes in Jambs for Hinges to be drilled in field.

Corrugated Steel to be same gauge as siding and is to be riveted in field to top and bottom angles of inside frame.
RIVETS - For Inside Frame, *5 Wire; For Outside Frame, ½"φ OPEN HOLES - for *5 Wire. Inside Frame to be shipped bolted in place.

C.A.B. Co's Standard
As Approved 2-28-10
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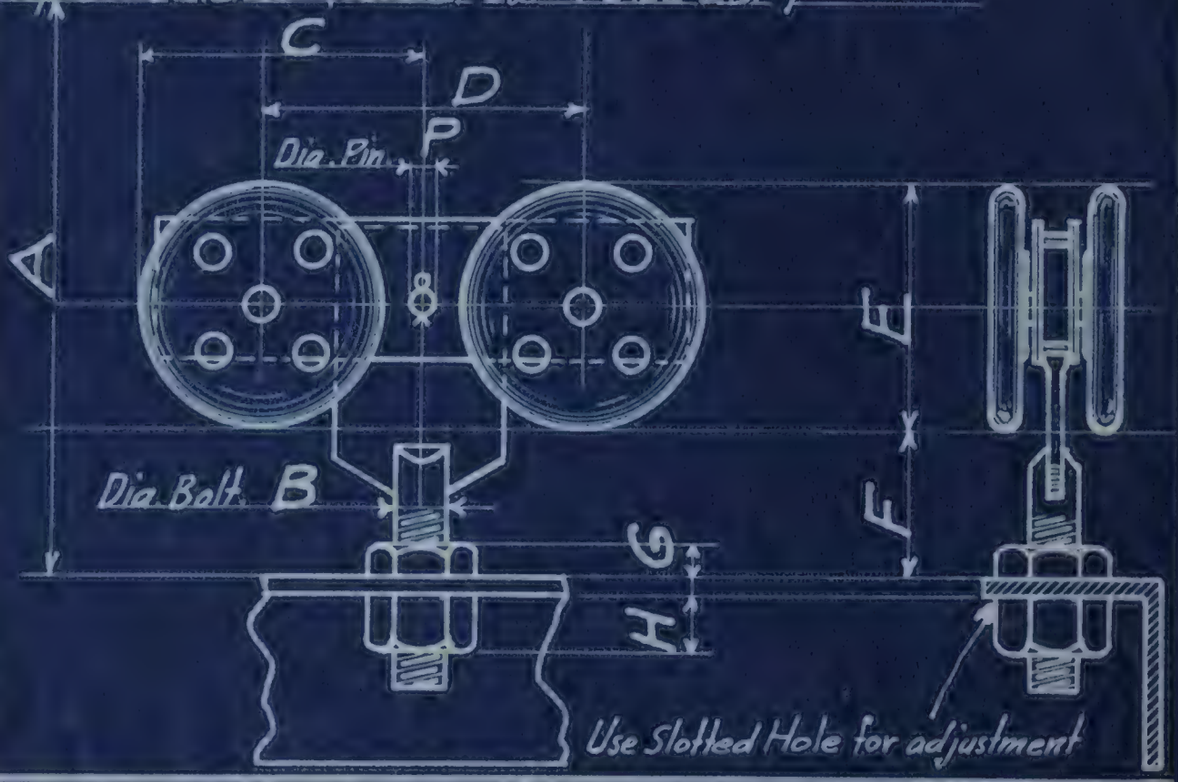
M9.1230 a

Coburn Tracks + Hangers - Steel Doors

Manufactured by the Coburn Trolley Track Mfg. Co.

Weight of Door	Track No.	Max. Lgth	Spcg of Brackets	Sketch	Trolley Number	Pendant Number	Min. Dist "A" Parallel Ear Bracket	Min. Dist "A" Side Ear Bracket
	1	8'-0"		1 11/16"	a	4	4 3/16	4 5/16
200*		"	4'-0"	2 1/16"	a	4	"	"
300		"	2'-0"		a	4	"	"
300	2 1/2	8'-0"	4'-0"	1 11/16" 3 3/16"	b	5	6 9/16	6 5/16
400		"	2'-6"		b	5	"	"
500		"	2'-0"		b	5	"	"
600	4	5'-0"	5'-0"	2 7/8" 3 3/4"	c	6	6 13/16	6 11/16
800		"	4'-0"		c	6	"	"
1000		"	2'-6"		c	6	"	"
1500		"	2'-0"		c	6	"	"
2000		"	1'-8"		c	6	"	"
6000	5		4'-0"	4 5/16"		8		
8000			2'-6"					
10000			2'-0"					
12000			1'-8"					
14000			1'-3"					

Top of Bracket (Parallel Ear + Side Ear)



Trolley No.	C	D	E	P
a	2 5/8	3 3/8	1 7/8	5/16
b	3 7/16	3 3/8	3	5/16
c	3 7/8	4 3/8	3 3/8	3/8

Pendant No.	B	F	G	H	P
4	1/2	1 3/4	5/16	1/2	5/16
5	1/2	2	5/16	1/2	5/16
6	3/4	2	7/16	3/4	3/8

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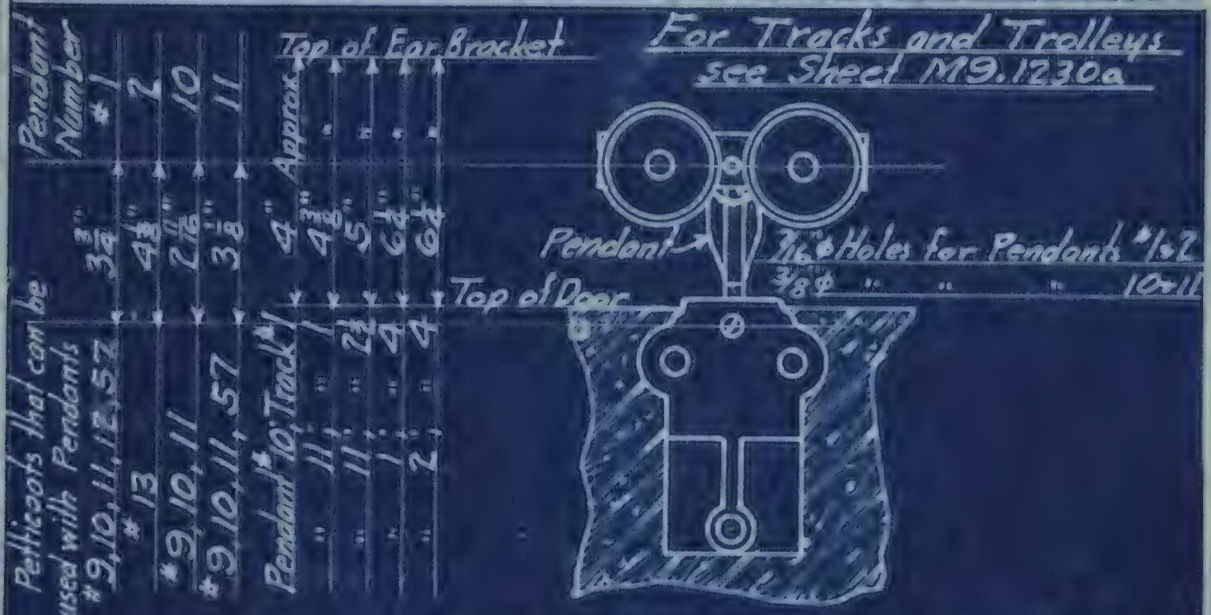
- A.S.C.E.'s Standard -
As Approved - 3-1-17

M9.1231 a

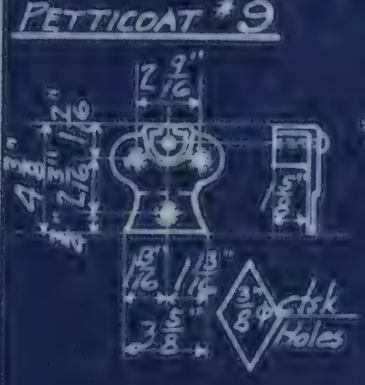
COBURN WOOD DOOR HANGERS -

Weight of Door in Lbs.	Thickness of Door	Petticoat 2" Screw	Petticoat 2½" Screw	Petticoat 3½" Screw	Trolley	Pendant Number	Track Number	Parallel Ear Bracket Center	Parallel Ear Bracket End	Side Wall Bracket Center	Side Wall Bracket Right End	Side Wall Bracket Left End
Up to 150	2"	*9			a	10	1	21	22	16	14	15
150 to 300	2"	*10			a	10,11	1	21	22	16	14	15
150 " 300	2½ to 3"		*11		a	11	1	21	22	16	14	15
300 " 500	2½ to 3		*11		b	11	2½	330	331	217	218	219
500 " 800	2"	*57			c	1	4	52	53	44	45	46
800 " 1200	3"		*12		c	1	4	52	53	44	45	46
over 1200	3 to 4"			*13	c	2	4	52	53	44	45	46

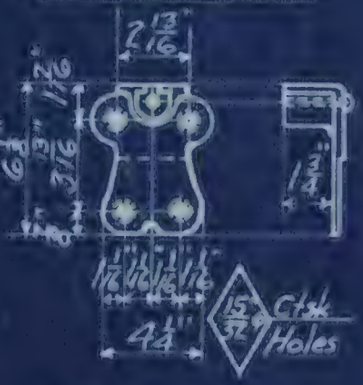


For Tracks and Trolleys see Sheet M9.1230a

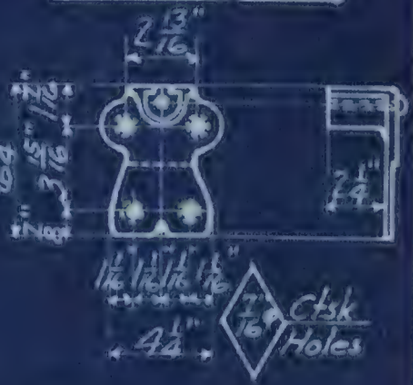
PETTICOAT *9



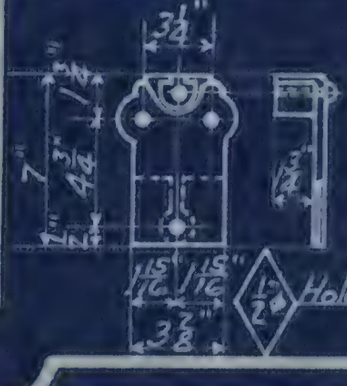
PETTICOAT *10



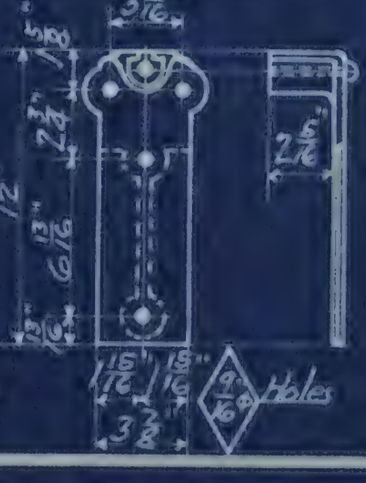
PETTICOAT *11



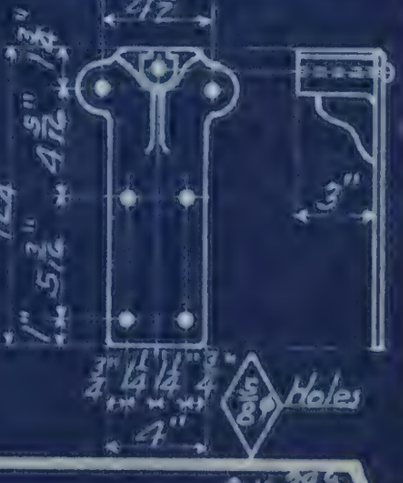
PETTICOAT *57



PETTICOAT *12



PETTICOAT *13



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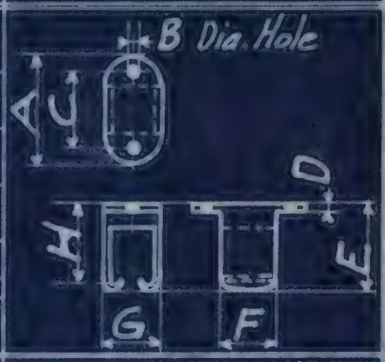
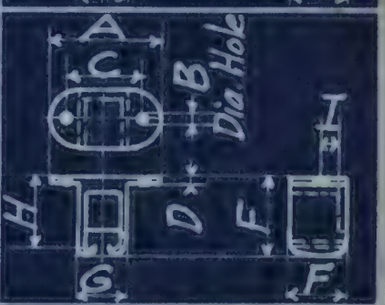
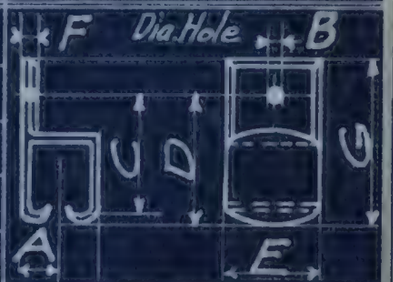
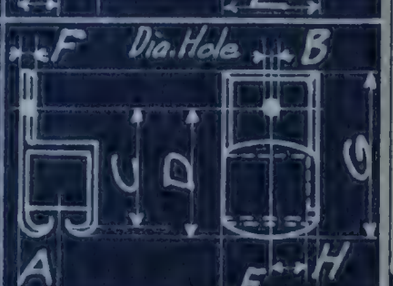
C.B. Co's Standard.
As Approved.

COBURN TRACK BRACKETS

Manufactured by the Coburn Trolley Track Mfg. Co.

	Tk. No	A	B	C	D	E	F	G	H	I	Pat. No. Sight	Pat. No. Curve	Sketch
Standard Parallel Ear Bracket	0	2 7/8	9/32 ctsk	2 3/16	1/4	2 5/16	1 2/16	1 9/16	2 1/16		89		
	1	4 3/8	1/2	3 1/4	5/16	3 1/4	2 1/16	2 3/8	3 1/16		21		
	2 1/2	5	9/16	3 1/2	5/16	4 1/2	2 3/16	2 5/16	4 1/4		221	330c	
	4	6 3/16	9/16	4 3/4	11/16	5 1/2	3	3 3/4	5 1/8		52	172	
	4½" Wheel 5	6	13/16	4	13/16	7 7/8	4	6	7 1/8		793		
	6" Wheel 5	7	13/16	5	2/8	8 15/16	4	5 13/16	8 1/16		600	600c	
End Parallel Ear Bracket	0	2 7/8	1/4	2	1/4	2 1/4	1 2/16	1 9/16	2	1/2	90		
	1	4 5/8	1/2	3 1/4	3/8	3 1/2	2	2 7/16	3 3/16	3/4	22		
	2 1/2	4 1/2	9/16	3 1/2	5/16	4 2/16	2 1/8	2 5/16	4 1/4	1	331		
	3	6 1/8	9/16	4 1/2	2/16	5 3/8	3	3 5/8	5	1 1/8	53		
	4	6 1/8	9/16	4 1/2	2/16	5 3/8	3	3 5/8	5	1 1/8	53		
Standard Side Ear Bracket	0	3	5/16 ctsk	2 3/16	5/16	2	1 3/8	1 9/16	1 3/4		91		
	1	4 13/16	7/16	3 3/8	3/8	2 7/8	2 3/8	2 3/8	2 21/32		23		
	2 1/2	4 1/2	9/16	3 1/2	13/32	4 1/16	2 7/16	2 7/16	3 13/16		223		
	4	8	3/4	5 11/16	1/16	5 3/16	4 1/8	4 1/8	4 3/4		173	173c	
	4½" Wheel 5	10	13/16	7 1/8	1	7 1/4	4 1/4	5 13/16	6 9/16		277	277c	
End Side Ear Bracket	0	3	1/4	2 3/16	1/4	2	1 3/8	1 1/2	1 13/16	1/2	92		
	1	4 3/4	1/2	3 7/16	3/8	2 7/8	2	2 3/8	2 11/16	3/4	24		
	2 1/2	4 5/8	1/2	3 1/2	3/8	4	2 3/8	2 3/8	3 13/16	15/16	224		
	3	7	1/2	5 3/8	9/16	4 13/16	2 9/16	3 5/8	4 1/2	1 1/8	238		
	4	8	11/16	5 5/8	1 1/8	5 1/4	4 1/4	4	4 3/4	1 5/8	51		

	Tk No	A	B	C	D	E	F	G	H	Pat. No. Cent.	Pat. No. R. End.	Pat. No. L. End.	Sketch
Single Wall Bracket	0	23/32	1/4	2 1/4	2 1/2	1 2/16	1/4	3		85			
	1	1 1/8	9/16	3 5/16	3 9/16	2 5/8	7/16	4 1/2		16			
	2 1/2	1 7/32	9/16	4 9/16	4 13/16	2 11/16	9/16	5 25/32		217			
	3	1 3/4	11/16	5 1/4	5 23/32	3 1/8	11/16	6 3/4		47			
	4	1 13/16	2/8	5 15/32	6 1/32	3 2/8	3/4	7 1/2		44			
End Wall Bracket	0	3/4	1/4	2 1/4	2 1/2	1 1/2	1/4	3	1/2	86	87		
	1	1 1/8	9/16	3 1/8	3 3/8	2	3/8	4 1/2	3/4	14	15		
	2 1/2	1 1/4	9/16	4 1/2	4 3/4	2	1/2	5 3/4	3/4	218	219		
	3	1 3/4	11/16	5 1/4	5 1/2	2	5/8	6 3/4	3/4	48	49		
	4	1 7/8	2/8	5 3/4	6 1/8	2 1/2	5/8	7 1/2	1	45	46		

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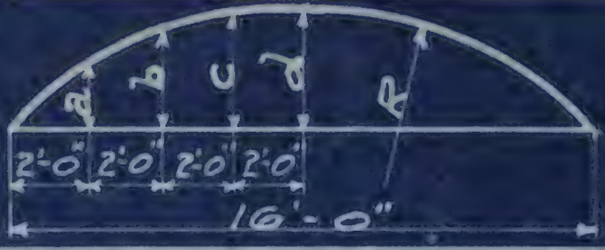
A.B.C.'s Standard
N.Y. Approved, 6-1-11

018.041 a

ORDINATES



For 16'-0" Templets.
"R" given in Ft. & Inches.
Ordinates given in Inches.

R	Ordinates a	b	c	d	R	Ordinates a	b	c	d
16'-6"	11 1/4	18 3/8	23 3/8	24 7/8	33'-6"	5 1/8	8 3/4	10 7/8	11 3/8
16'-8	11 1/8	18 3/4	23 1/8	24 1/2	34'-3	5	8 1/2	10 5/8	11 3/8
16'-10	11	18 1/2	22 7/8	24 1/4	35'-0	4 7/8	8 3/8	10 3/8	11 1/8
17'-0	10 7/8	18 1/4	22 5/8	24	35'-9	4 3/4	8 1/8	10 1/4	10 7/8
17'-2	10 3/4	18 1/8	22 3/8	23 3/4	36'-6	4 3/4	8	10	10 3/8
17'-4	10 5/8	17 7/8	22 1/8	23 1/2	37'-3	4 5/8	7 7/8	9 3/4	10 3/8
17'-6	10 1/2	17 5/8	21 7/8	23 1/4	38'-0	4 1/2	7 5/8	9 5/8	10 1/4
17'-8	10 3/8	17 1/2	21 5/8	23	38'-9	4 3/8	7 1/2	9 3/8	10
17'-10	10 1/4	17 1/4	21 3/8	22 3/4	39'-6	4 3/8	7 3/8	9 1/4	9 7/8
18'-0	10 1/8	17 1/8	21 1/8	22 1/2	40'-3	4 1/4	7 1/4	9	9 5/8
18'-2	10	16 7/8	21	22 1/4	41'-0	4 1/8	7 1/8	8 7/8	9 1/2
18'-4	9 7/8	16 3/4	20 3/4	22	42'-0	4	6 7/8	8 5/8	9 1/4
18'-6	9 7/8	16 1/8	20 1/2	21 7/8	43'-0	4	6 3/4	8 1/2	9
18'-8	9 3/4	16 3/8	20 3/8	21 5/8	44'-0	3 7/8	6 5/8	8 1/4	8 1/4
18'-10	9 5/8	16 1/4	20 1/8	21 3/8	45'-0	3 3/4	6 1/2	8 1/8	8 5/8
19'-0	9 1/2	16 1/8	19 7/8	21 1/4	46'-3	3 5/8	6 1/4	7 7/8	8 3/8
19'-2	9 3/8	15 7/8	19 3/4	21	47'-6	3 5/8	6 1/8	7 5/8	8 1/8
19'-4	9 3/8	15 3/4	19 1/2	20 3/4	48'-3	3 1/2	6	7 1/2	7 7/8
19'-6	9 1/4	15 5/8	19 3/8	20 5/8	50'-0	3 3/8	5 3/4	7 1/4	7 3/4
19'-8	9 1/8	15 1/2	19 1/8	20 3/8	51'-6	3 1/4	5 5/8	7	7 1/2
19'-10	9 1/8	15 3/8	19	20 1/4	53'-0	3 1/4	5 1/2	6 7/8	7 1/4
20'-0	9	15 1/8	18 7/8	20	54'-6	3 1/8	5 3/8	6 5/8	7 1/8
20'-3	8 7/8	15	18 5/8	19 3/4	56'-0	3	5 1/8	6 1/2	6 7/8
20'-6	8 3/4	14 3/4	18 3/8	19 1/2	58'-0	2 7/8	5	6 1/4	6 5/8
20'-9	8 5/8	14 5/8	18 1/8	19 1/4	60'-0	2 7/8	4 7/8	6	6 3/8
21'-0	8 1/2	14 3/8	17 7/8	19	62'-6	2 3/4	4 5/8	5 3/4	6 1/8
21'-3	8 3/8	14 1/4	17 5/8	18 3/4	65'-0	2 5/8	4 1/2	5 1/2	5 7/8
21'-6	8 1/4	14	17 3/8	18 1/2	67'-6	2 1/2	4 1/4	5 3/8	5 3/4
21'-9	8 1/8	13 7/8	17 1/4	18 1/4	70'-0	2 3/8	4 1/8	5 1/8	5 1/2
22'-0	8 1/8	13 5/8	17	18 1/8	72'-6	2 3/8	4	5	5 3/8
22'-3	8	13 1/2	16 3/4	17 7/8	75'-0	2 1/4	3 7/8	4 7/8	5 1/8
22'-6	7 7/8	13 3/8	16 5/8	17 5/8	77'-6	2 1/8	3 3/4	4 5/8	5
22'-9	7 3/4	13 1/8	16 3/8	17 3/8	80'-0	2 1/8	3 5/8	4 1/2	4 7/8
23'-0	7 5/8	13	16 1/4	17 1/4	84'-0	2	3 1/2	4 1/4	4 5/8
23'-4	7 1/2	12 7/8	16	17	88'-0	1 7/8	3 1/4	4 1/8	4 3/8
23'-8	7 1/2	12 5/8	15 3/4	16 3/4	92'-0	1 7/8	3 1/8	3 7/8	4 1/8
24'-0	7 3/8	12 1/2	15 1/2	16 1/2	96'-0	1 3/4	3	3 3/4	4
24'-4	7 1/4	12 1/4	15 1/4	16 1/4	100'-0	1 5/8	2 7/8	3 5/8	3 7/8
24'-8	7 1/8	12 1/8	15	16	105'-0	1 5/8	2 3/4	3 3/8	3 5/8
25'-0	7	11 7/8	14 7/8	15 3/4	110'-0	1 1/2	2 5/8	3 1/4	3 1/2
25'-4	6 7/8	11 3/4	14 5/8	15 1/2	115'-0	1 1/2	2 1/2	3 1/8	3 3/8
25'-8	6 3/4	11 5/8	14 3/8	15 3/8	120'-0	1 3/8	2 3/8	3	3 1/4
26'-0	6 3/4	11 3/8	14 1/4	15 1/8	130'-0	1 1/4	2 1/4	2 3/4	3
26'-4	6 5/8	11 1/4	14	14 7/8	140'-0	1 1/4	2	2 5/8	2 3/4
26'-8	6 1/2	11 1/8	13 7/8	14 3/4	150'-0	1 1/8	1 7/8	2 3/8	2 1/2
27'-0	6 1/2	11	13 5/8	14 1/2	160'-0	1	1 3/4	2 1/4	2 3/8
27'-6	6 3/8	10 3/4	13 3/8	14 1/4	180'-0	7/8	1 5/8	2	2 1/8
28'-0	6 1/4	10 1/2	13 1/8	14	200'-0	7/8	1 1/2	1 3/4	1 7/8
28'-6	6 1/8	10 3/8	12 7/8	13 3/4	225'-0	3/4	1 1/4	1 5/8	1 3/4
29'-0	6	10 1/8	12 5/8	13 1/2	250'-0	5/8	1 1/8	1 1/2	1 1/2
29'-6	5 7/8	10	12 1/2	13 1/4	300'-0	1/2	1	1 1/4	1 1/4
30'-0	5 3/4	9 7/8	12 1/4	13	350'-0	1/2	7/8	1	1 1/8
30'-6	5 5/8	9 5/8	12	12 7/8	400'-0	3/8	3/4	7/8	1
31'-0	5 5/8	9 1/2	11 7/8	12 5/8	500'-0	3/8	5/8	3/4	3/4
31'-6	5 1/2	9 3/8	11 5/8	12 3/8	625'-0	1/4	1/2	5/8	5/8
32'-0	5 3/8	9 1/8	11 1/2	12 1/4	750'-0	1/4	3/8	1/2	1/2
32'-9	5 1/4	9	11 1/8	11 7/8	1000'-0	1/8	1/4	3/8	3/8

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A.R.C.O. Standard
As Approved: 6-10-27

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As Approved; 5-13-09.

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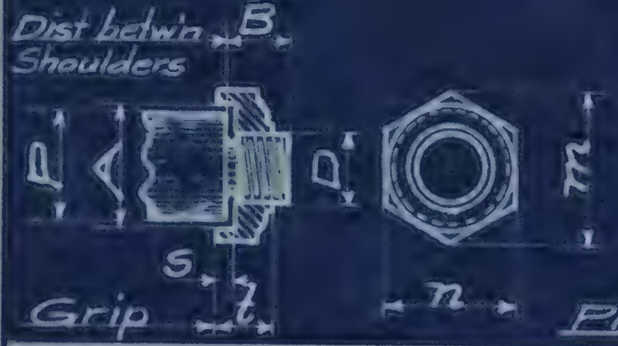
PINS — LOMAS NUTS



Shape of Thread - U.S.Std. Pitch - 6 Threads per inch. See Sheets - T 8.181a

Grip = Distance between nuts. For Grip add allowances as per Sheet For Distance between Shoulders add to the Grip the Amount given in Table.

For Pins up to 10" diam., Pin Holes to be 1/32" larger than Diam. of Pin unless otherwise speified. For Pins above 10" diam. a hole should be bored through the Pin and a Pin Cap used. These Caps to be held by rods going through the Pin.

Pins marked # are special. All Dimensions given in Inches.

PIN							NUT							
Diam. of Pin P				Thread		Add to Grip	Thickness	Sh't Dia.	Lg. Dia	Ins'd Dia.	Depth	Dia. of Roughing	Wt. Lbs.	Patt. No.
				D	B		t	n	m	A	S			
		2	2 1/4	1 1/2	1	1/4	7/8	2 15/16	3 3/8	2 5/8	1/4	1 5/16	1.1	P.N.21
		2 1/2	2 3/4	2	1 1/8	1/4	1	3 9/16	4 1/8	3 1/8	1/4	1 13/16	1.7	" 22
	3	# 3 1/4	3 1/2	2 1/2	1 1/4	1/4	1 1/8	4 5/16	5	3 7/8	3/8	2 5/16	2.5	" 23
		# 3 3/4	4	3	1 3/8	1/2	1 1/4	4 7/8	5 5/8	4 3/8	3/8	2 13/16	3.7	" 24
	# 4 1/4	4 1/2	# 4 3/4	3 1/2	1 1/2	1/2	1 3/8	5 3/4	6 5/8	5 1/4	1/2	3 5/16	4.6	" 25
		5	# 5 1/4	4	1 5/8	1/2	1 1/2	6 1/4	7 3/16	5 3/4	1/2	3 13/16	6.2	" 26
	5 1/2	# 5 3/4	6	4 1/2	1 3/4	1/2	1 5/8	7	8 1/8	6 1/2	5/8	4 5/16	7.8	" 27
		# 6 1/4	# 6 1/2	5	1 7/8	3/4	1 3/4	7 5/8	8 7/8	7	5/8	4 13/16	9.9	" 28
		# 6 3/4	7	5 1/2	2	3/4	1 7/8	8 1/8	9 3/8	7 1/2	3/4	5 5/16	11.8	" 29
		# 7 1/4	# 7 1/2	5 1/2	2	3/4	1 7/8	8 5/8	10	8	3/4	5 5/16	14.3	" 30
	# 7 3/4	8	# 8 1/4	6	2 1/4	3/4	2 1/8	9 3/8	10 7/8	8 3/4	3/4	5 13/16	18.6	" 31
	# 8 1/2	# 8 3/4	9	6	2 1/4	3/4	2 1/8	10 1/4	11 7/8	9 5/8	3/4	5 13/16	23.8	" 32
# 9 1/4	# 9 1/2	# 9 3/4	10	6	2 3/8	3/4	2 1/4	11 1/4	13	10 5/8	3/4	5 13/16	31.1	" 33

P9.141a

A.B.Co's Standard

As Approved: 7-2-'29

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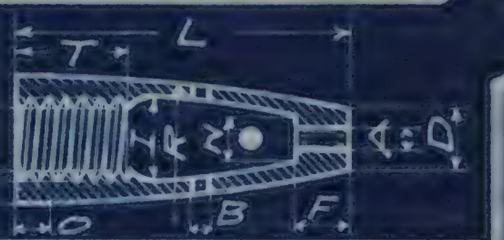
LONG PILOT NUTS

Pilot Nuts are made of special hard steel and finished all over
Screw - 6 Threads per inch.

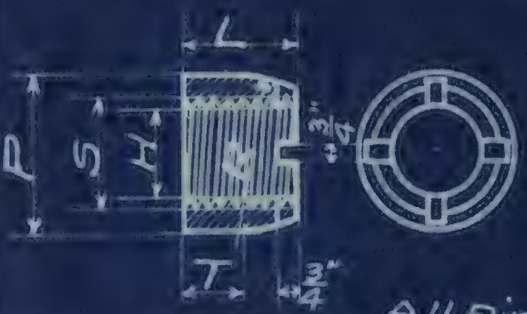


Dia Nut P	Dia Screw S	Dia of Rough Hole H	Length Thread T	Length over All L	Straight Portion Inside E	Dia. Inside I	Straight Portion Outside O	D	Radius R	F	Clear for Nut N	Dia of Hole A	Dia. of Hole B	Pattern No.	Wt. Lbs.
2	1 1/2	1 5/16	2	5	2		3/4	1	18 1/2	1		1/2	3/4	PL 8	1.5
2 1/4	"	"	"	"	"		1/4	"	"	"		"	"	9	2
2 1/2	2	1 13/16	"	6	"		1/2	"	20 1/2	1 1/8		5/8	"	10	3
2 3/4	"	"	"	"	"		1/16	"	"	"		"	"	11	4
3	2 1/2	2 5/16	"	7	"		1 1/16	1 1/4	"	1 1/4		3/4	"	12	5
3 1/4	"	"	"	"	"		11/16	"	"	"		"	"	13	7
3 1/2	"	"	"	"	"		5/16	"	"	"		"	"	14	9
3 3/4	3	2 13/16	2 3/8	8	2 1/2		1 9/16	1 1/2	"	2		7/8	"	15	11
4	"	"	"	"	"		1 3/16	"	"	"		"	"	16	12
4 1/4	3 1/2	3 5/16	"	9	"		1/8	1 3/4	27	"	1 1/2	1	"	17	14
4 1/2	"	"	"	"	"		1/2	"	"	"	"	"	"	18	16
4 3/4	"	"	"	"	"		1/8	"	"	"	"	"	"	19	19
5	4	3 13/16	"	10	"		1 1/8	2	"	"	1 5/8	"	1	20	24
5 1/4	"	"	"	"	"		1/4	"	"	"	"	"	"	21	30
5 1/2	4 1/2	4 5/16	"	11 1/2	"		1 1/8	2 3/4	40	2 1/2	2 3/16	1 1/2	"	22	33
5 3/4	"	"	"	"	"		5/8	"	"	"	"	"	"	23	40
6	"	"	"	"	"		1/16	"	"	"	"	"	"	24	45
6 1/4	5	4 13/16	2 1/8	13	3		1 5/16	"	"	"	"	"	"	25	49
6 1/2	"	"	"	"	"		7/8	"	"	"	"	"	"	26	58
6 3/4	5 1/2	5 5/16	"	14 1/2	"		1 1/2	"	43	"	"	"	"	27	64
7	"	"	"	"	"		1 1/8	"	"	"	"	"	"	28	70
7 1/4	"	"	"	"	"		1/4	"	"	"	"	"	"	29	77
7 1/2	"	"	"	"	"		3/8	"	"	"	"	"	"	30	85
7 3/4	6	5 13/16	"	16	"		1 9/16	"	"	"	"	"	"	31	95
8	"	"	"	"	"		1 5/16	"	"	"	"	"	"	32	102
8 1/4	"	"	"	"	"		1/8	"	"	"	"	"	"	33	110
8 1/2	"	"	2 1/2	17 1/2	"	6 1/2	1 3/16	3	52	2 3/4	2 1/2	"	"	34	92
8 3/4	"	"	"	"	"		1/16	"	"	"	"	"	"	35	99
9	"	"	"	"	"		1/8	"	"	"	"	"	"	36	107
9 1/4	"	"	3	19 1/2	"	7 1/4	1 1/4	"	"	"	"	"	1 1/2	37	119
9 1/2	"	"	"	"	"	"	1 3/8	"	"	"	"	"	"	38	130
9 3/4	"	"	"	"	"	"	1 1/16	"	"	"	"	"	"	39	142
10	"	"	"	"	"	"	3/4	"	"	"	"	"	"	40	156
10 1/4	"	"	"	21 1/2	"	8	1 1/2	"	57	"	"	"	"	41	160
10 1/2	"	"	"	"	"	"	1 3/16	"	"	"	"	"	"	42	172
10 3/4	"	"	"	"	"	"	1 1/16	"	"	"	"	"	"	43	186
11	"	"	"	"	"	"	1/2	"	"	"	"	"	"	44	203

P9.142a

SHORT PILOT NUTS

Pilot Nuts are made of special hard steel and are finished all over.
Screw - 6 Threads per inch. See Shts. T 8.181 a



When Short Pilot Nuts are needed on bottom chord pins, Long Pilot Nuts are to be sent for all other pins in addition.

All Dimensions given in Inches.

Diam. Nut P	Diam. Screw S	Dia. Rgh Hole H	Length over all L	Straight Portion T	Radius R	Pattern No.	Weight Lbs.
2	1 1/2	1 5/16	2	1 1/4	4 1/4	P.S. 8	.5
2 1/4	"	"	"	"	"	9	1.0
2 1/2	2	1 13/16	"	1	"	10	1.0
2 3/4	"	"	"	"	"	11	1.5
3	2 1/2	2 5/16	"	"	"	12	1.3
3 1/4	"	"	"	"	"	13	2.0
3 1/2	"	"	"	"	"	14	3
3 3/4	3	2 13/16	2 1/2	"	"	15	3
4	"	"	"	"	"	16	4
4 1/4	3 1/2	3 5/16	"	"	"	17	3
4 1/2	"	"	"	"	"	18	4
4 3/4	"	"	"	"	"	19	5
5	4	3 13/16	"	"	"	20	5
5 1/4	"	"	"	"	"	21	6
5 1/2	4 1/2	4 5/16	"	"	"	22	5
5 3/4	"	"	"	"	"	23	6
6	"	"	"	"	"	24	8
6 1/4	5	4 13/16	3	1 1/4	"	25	9
6 1/2	"	"	"	"	"	26	11
6 3/4	5 1/2	5 5/16	"	"	"	27	10
7	"	"	"	"	"	28	12
7 1/4	"	"	"	"	"	29	14
7 1/2	"	"	"	"	"	30	16
7 3/4	6	5 13/16	"	1/2	6 1/2	31	14
8	"	"	"	"	"	32	16
8 1/4	"	"	"	"	"	33	19
8 1/2	"	"	"	"	"	34	21
8 3/4	"	"	"	"	"	35	24
9	"	"	"	"	"	36	28
9 1/4	"	"	3 1/2	"	7	37	33
9 1/2	"	"	"	"	"	38	36
9 3/4	"	"	"	"	"	39	40
10	"	"	"	"	"	40	45
10 1/4	"	"	"	"	"	41	48
10 1/2	"	"	"	"	"	42	51
10 3/4	"	"	"	"	"	43	55
11	"	"	"	"	"	44	59

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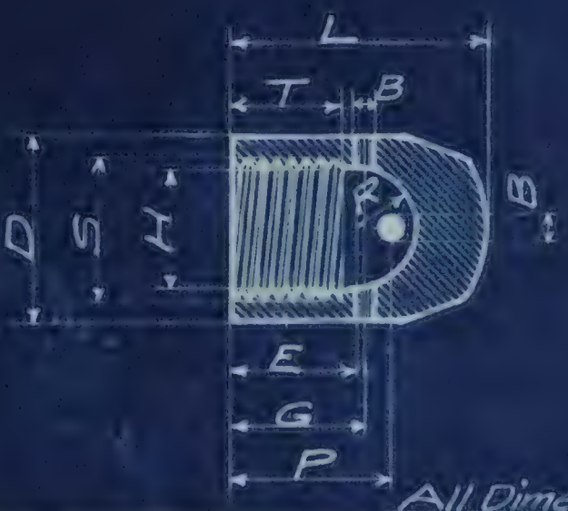
· A.B.C.'s Standard ·
As Approved, 7-2-'09.

DRIVING NUTS

Driving Nuts are made of special hard steel.
Screw - 6 Threads per inch. See Shts T8.181a



All Dimensions given in Inches.

Dia of Nut D	Dia. of Screw S	Dia. Rough Hole H	Length of Thread T	Length over All L	St. Portion Inside E	Inside Radius R	G	P	Diam. of Holes B	Patt. No	Wt. Lbs
2 3/8	1 1/2	1 5/16	2	4	2 1/4	21/32	2	2 9/16	3/4	P.D.3	4
2 7/8	2	1 13/16	"	4 3/8	"	29/32	2 1/16	2 3/4	"	4	5
3 5/8	2 1/2	2 5/16	"	5	2 5/8	1 5/32	2 3/8	3 3/16	"	5	8
4 1/8	3	2 13/16	2 3/8	5 1/4	"	1 13/32	2 1/2	3 3/8	"	6	11
4 7/8	3 1/2	3 5/16	"	5 7/8	"	1 21/32	"	3 1/2	"	7	17
5 3/8	4	3 13/16	"	6 3/8	"	1 29/32	2 5/8	3 3/4	1	8	22
6 1/4	4 1/2	4 5/16	"	6 3/4	"	2 5/32	2 3/4	3 7/8	"	9	27
6 3/4	5	4 13/16	2 7/8	7 1/8	3	2 13/32	3 3/8	4 5/8	"	10	37
7 3/4	5 1/2	5 5/16	"	7 5/8	"	2 21/32	"	"	"	11	56
8 1/2	6	5 13/16	"	7 7/8	"	2 29/32	"	"	"	12	67
9 1/4	"	"	"	"	"	"	"	4 7/8	1 1/2	13	86
10 1/4	"	"	3	8 3/8	3 1/2	"	4	5 1/2	"	14	120
11 1/4	"	"	"	"	"	"	"	"	"	15	150

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- A.B.Co's Standard -
As Approved: 7-7-09

C.H. Jones 2-6-10

MAX. BENDING MOMENTS OF PINS AND BEARING VALUES OF PINS ON PLATES 1" THICK FOR VARYING UNIT VALUES IN THOUSANDS OF LBS.

PIN		MAX. BENDING MOMENT FOR						BERG VALUES OF 1" PLATE				
		Varius Fibre Stresses per Sq. In.						Varius Bearing Values per Sq. Ins.				
Dia Ins.	Area Sq. Ins.	15000	18000	20000	22000	24000	25000	12000	15000	20000	22000	24000
1	.785	1.47	1.77	1.96	2.16	2.36	2.45	12.0	15.0	20.0	22.0	24.0
1¼	1.227	2.88	3.45	3.83	4.22	4.6	4.79	15.0	18.8	25.0	27.5	30.0
1½	1.767	4.97	5.96	6.63	7.29	7.95	8.28	18.0	22.5	30.0	33.0	36.0
1¾	2.405	7.89	9.47	10.5	11.58	12.63	13.2	21.0	26.3	35.0	38.5	42.0
2	3.142	11.8	14.1	15.7	17.28	18.8	19.6	24.0	30.0	40.0	44.0	48.0
2¼	3.976	16.8	20.1	22.4	24.6	26.8	28.0	27.0	33.8	45.0	49.5	54.0
2½	4.909	23.0	27.6	30.7	33.7	36.8	38.3	30.0	37.5	50.0	55.0	60.0
2¾	5.940	30.6	36.8	40.8	44.9	49.0	51.0	33.0	41.3	55.0	60.5	66.0
3	7.069	39.8	47.7	53.0	58.3	63.6	66.3	36.0	45.0	60.0	66.0	72.0
3¼	8.296	50.6	60.7	67.4	74.1	80.9	84.3	39.0	48.8	65.0	71.5	78.0
3½	9.621	63.1	75.8	84.2	92.6	101.0	105.2	42.0	52.5	70.0	77.0	84.0
3¾	11.045	77.7	93.2	103.5	113.9	124.3	129.4	45.0	56.3	75.0	82.5	90.0
4	12.566	94.2	113.1	125.7	138.2	150.8	157.1	48.0	60.0	80.0	88.0	96.0
4¼	14.186	113.0	135.7	150.7	165.8	180.9	188.4	51.0	63.8	85.0	93.5	102.0
4½	15.904	134.2	161.0	178.9	196.8	214.7	223.7	54.0	67.5	90.0	99.0	108.0
4¾	17.721	157.8	189.4	210.4	231.5	252.5	263.0	57.0	71.3	95.0	104.5	114.0
5	19.635	184.1	220.9	245.4	270.0	294.5	306.8	60.0	75.0	100.0	110.0	120.0
5¼	21.648	213.1	255.7	284.1	312.5	340.9	355.2	63.0	78.8	105.0	115.5	126.0
5½	23.758	245.0	294.0	326.7	359.3	392.0	408.3	66.0	82.5	110.0	121.0	132.0
5¾	25.967	280.0	336.0	373.3	410.6	447.9	466.6	69.0	86.3	115.0	126.5	138.0
6	28.274	318.1	381.7	424.1	466.5	508.9	530.1	72.0	90.0	120.0	132.0	144.0
6¼	30.680	359.5	431.4	479.4	527.3	575.2	599.2	75.0	93.8	125.0	137.5	150.0
6½	33.183	404.4	485.3	539.2	593.1	647.1	674.0	78.0	97.5	130.0	143.0	156.0
6¾	35.785	452.9	543.5	603.9	664.3	724.6	754.8	81.0	101.3	135.0	148.5	162.0
7	38.485	505.1	606.1	673.5	740.8	808.2	841.8	84.0	105.0	140.0	154.0	168.0
7¼	41.282	561.2	673.4	748.2	823.1	897.9	935.3	87.0	108.8	145.0	159.5	174.0
7½	44.179	621.3	745.5	828.4	911.2	994.0	1035.4	90.0	112.5	150.0	165.0	180.0
7¾	47.173	685.5	822.6	914.0	1005.4	1096.8	1142.5	93.0	116.3	155.0	170.5	186.0
8	50.265	754.0	904.8	1005.3	1105.8	1206.4	1256.6	96.0	120.0	160.0	176.0	192.0
8¼	53.456	826.9	992.3	1102.5	1212.8	1323.0	1378.2	99.0	123.8	165.0	181.5	198.0
8½	56.745	904.4	1085.3	1205.8	1326.4	1447.0	1507.3	102.0	127.5	170.0	187.0	204.0
8¾	60.132	986.5	1183.9	1315.4	1446.9	1578.5	1644.2	105.0	131.3	175.0	192.5	210.0
9	63.617	1073.5	1288.2	1431.4	1574.5	1717.7	1789.2	108.0	135.0	180.0	198.0	216.0
9¼	67.201	1165.5	1398.6	1554.0	1709.4	1864.8	1942.5	111.0	138.8	185.0	203.5	222.0
9½	70.882	1262.6	1515.1	1683.5	1851.8	2020.1	2104.3	114.0	142.5	190.0	209.0	228.0
9¾	74.662	1364.9	1637.9	1819.9	2001.9	2183.9	2274.9	117.0	146.3	195.0	214.5	234.0
10	78.540	1472.6	1767.1	1963.5	2159.8	2356.2	2454.4	120.0	150.0	200.0	220.0	240.0
10¼	82.516	1585.9	1903.0	2114.5	2325.9	2537.4	2643.1	123.0	153.8	205.0	225.5	246.0
10½	86.590	1704.7	2045.7	2273.0	2500.3	2727.6	2841.2	126.0	157.5	210.0	231.0	252.0
10¾	90.763	1829.4	2195.3	2439.2	2683.2	2927.1	3049.1	129.0	161.3	215.0	236.5	258.0
11	95.033	1960.1	2352.1	2613.4	2874.8	3136.1	3266.8	132.0	165.0	220.0	242.0	264.0
11¼	99.402	2096.8	2516.1	2795.7	3075.2	3354.8	3494.6	135.0	168.8	225.0	247.5	270.0
11½	103.869	2239.7	2687.6	2986.2	3284.9	3583.5	3732.8	138.0	172.5	230.0	253.0	276.0
11¾	108.434	2388.9	2866.7	3185.2	3503.8	3822.3	3981.6	141.0	176.3	235.0	258.5	282.0
12	113.097	2544.7	3053.6	3392.9	3732.2	4071.5	4241.2	144.0	180.0	240.0	264.0	288.0

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A.R.E.C.O's Standard
As Approved Sept. 1913

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WROUGHT IRON TUBES
GAS + WATER PIPE

All dimensions given in Inches; all weights in Lbs.

ORDINARY GAS OR WATER PIPE								HYDRAULIC TUBING			
								EXTRA		DOUBLE EXTRA	
Nominal Diam.	Outside Diam.	Thickness	Inside Diam.	Internal Area	External Area	Weight per Ft.	Threads per In.	Thickness	Inside Diam.	Thickness	Inside Diam.
1/8	.41	.07	.27	.06	.13	.24	27	.10	.21		
1/4	.54	.09	.36	.10	.23	.42	18	.12	.29		
3/8	.67	.09	.49	.19	.36	.56	18	.13	.42		
1/2	.84	.11	.62	.30	.55	.84	14	.15	.54	.30	.24
3/4	1.05	.11	.82	.53	.87	1.12	14	.16	.73	.31	.42
1	1.31	.13	1.05	.86	1.36	1.67	11 1/2	.18	.95	.36	.59
1 1/4	1.66	.14	1.38	1.50	2.16	2.24	11 1/2	.19	1.27	.39	.88
1 1/2	1.90	.15	1.61	2.04	2.84	2.68	11 1/2	.20	1.49	.40	1.09
2	2.37	.15	2.07	3.36	4.43	3.61	11 1/2	.22	1.93	.44	1.49
2 1/2	2.87	.20	2.47	4.78	6.49	5.74	8	.28	2.32	.56	1.76
3	3.50	.22	3.07	7.38	9.62	7.54	8	.30	2.89	.61	2.28
3 1/2	4.00	.23	3.55	9.89	12.57	9.00	8	.32	3.36	.64	2.72
4	4.50	.24	4.03	12.73	15.90	10.66	8	.34	3.82	.68	3.14
4 1/2	5.00	.25	4.51	15.96	19.64	12.49	8	.36	4.28	.72	3.56
5	5.56	.26	5.05	20.02	24.30	14.50	8	.38	4.81	.75	4.06
6	6.63	.28	6.07	28.89	34.47	18.76	8	.44	5.75	.87	4.88
7	7.63	.30	7.02	38.74	45.66	23.27	8	.50	6.63	.87	5.88
8	8.63	.32	7.98	50.03	58.43	28.18	8	.50	7.63	.87	6.88
9	9.63	.34	8.94	62.73	72.76	33.70	8				
10	10.75	.36	10.02	78.82	90.76	40.00	8				
11	11.75	.36	11.00	95.03	108.43	45.00	8				
12	12.75	.36	12.00	113.10	127.68	49.00	8				

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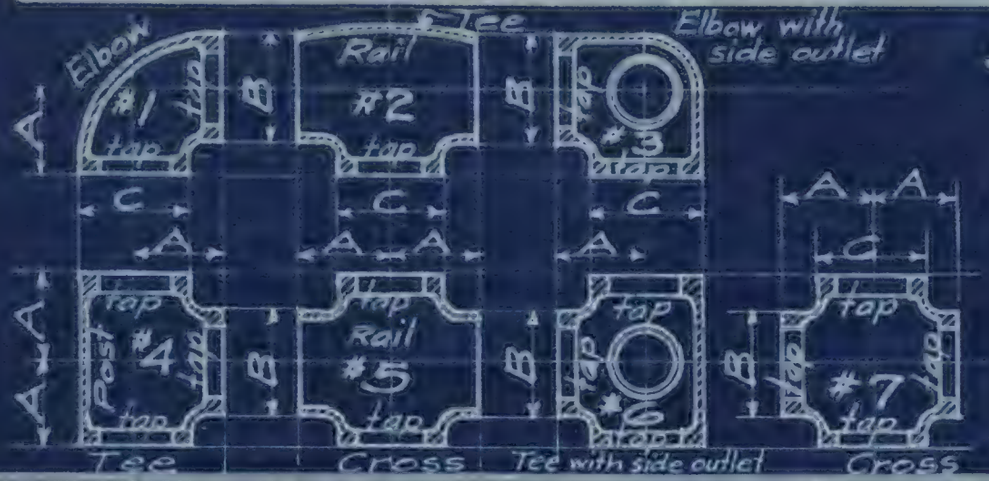


GAS PIPE FITTINGS

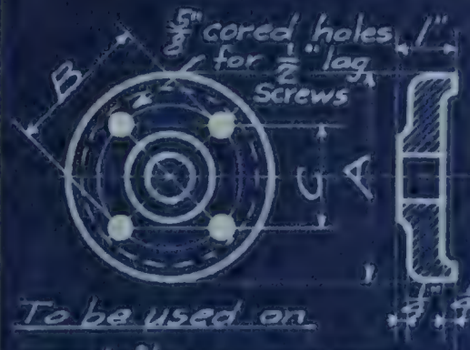
MALLEABLE IRON

All Fittings having "M" prefixed to the mark are Edge Moor Special. Pattern at Kewanee. All other Fittings are National Tube Co's Standards, carried in stock at Kewanee.

Post	Rail	Dimensions A	Dimensions B	Dimensions C	Ell #1	Tee #2	Ell #3	Tee #4	Cross #5	Tee #6	Cross #7
					Marks and Weights						
1¼	1¼	1¾	2	2	L1	M658	L9	T1	M660	T9	C1
					1#	1#	.88#	1.38#	1.25#	1.5#	1.5#
1½	1¼	2	2	2⅜	L2	M676		T2	M678		C2
					1.38#	1.25#		1.25#	1.5#		1.38#
	1½	2	2⅜	2⅜	L3	M664	L11	T3	M666	T11	C3
					1.38#	1.25#	1.63#	1.5#	1.5#	2#	2#
2	1½	2½	2⅜	2⅞	L4	M688		T4	M630		C4
					1.88#	2#		2.25#	2.25#		2.38#
	2	2½	2⅞	2⅞	L5	M670	L13	T5	M672	T13	C5
					2#	2#	2.25#	2.25#	2.25#	2.75#	2.75
2½	1½								M718		
									2.5#		
	2	2¾	3⅜	3⅜		M705		T7	M706		
						2.5#		5#	2.75#		
	2½	2¾	3⅜	3⅜	L8	M711		T8	M712		C8
					3.63#	3#		4.63#	3.25#		5.5#

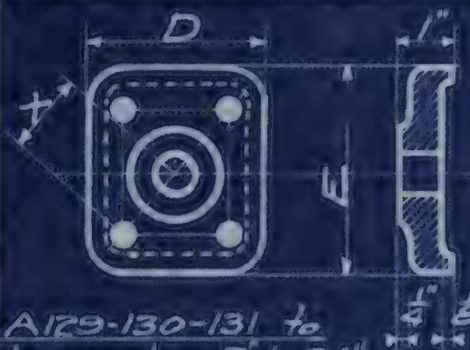
P9.162 a

GAS PIPE FITTINGS
GRAY CASTINGS



To be used on wood floors, masonry, etc.

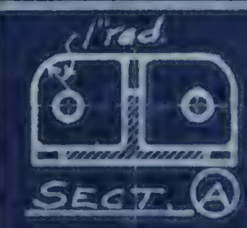
	PIPE							
	1 1/4"		1 1/2"		2"		2 1/2"	
A	5 3/4	7	5 3/4	7	6 1/2	8	8	8
B	3 7/8		3 7/8		4 1/4		5 5/8	
C	2 3/4		2 3/4		3		4	
Patt Nº	A121	A122	A123	A124	A125	A126	A127	A128
Wt.	4.0	5.6	3.8	5.2	4.6	7.0	6.9	7.0



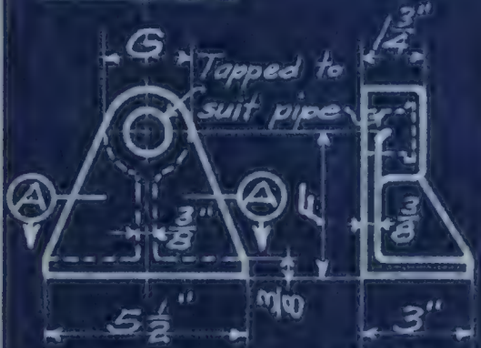
A129-130-131 to be used on 7" to 24" bms. incl. A132 on 7" to 12" bms. incl. A133 on 15" to 24" bms. incl.

Drill holes 1/16" larger than dia. of bolt. Dist. "X" is min. for 3/4" ϕ bolts. Use 3/4" ϕ bolts for 13/16" or 15/16" punching in beam.

	PIPE							
	1 1/4"		1 1/2"		2"		2 1/2"	
D	4 3/4		4 3/4		4 3/4		4 3/4	6
E	5 3/4		5 3/4		5 3/4		6 1/2	6
X	2 1/4		2 3/8		2 7/16		2 3/4	2 3/4
Patt Nº	A129		A130		A131		A132	A133
Wt.	5.5		5.0		4.8		5.3	5.6

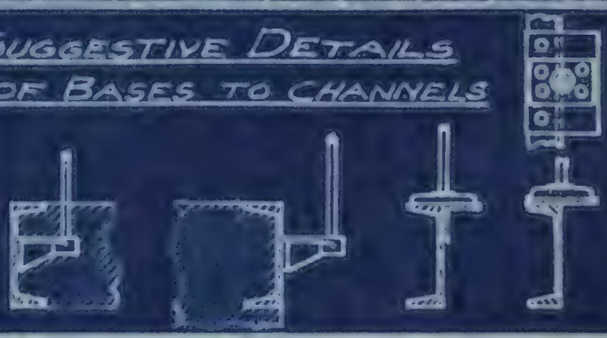


Holes to be drilled to suit holes in stringers.

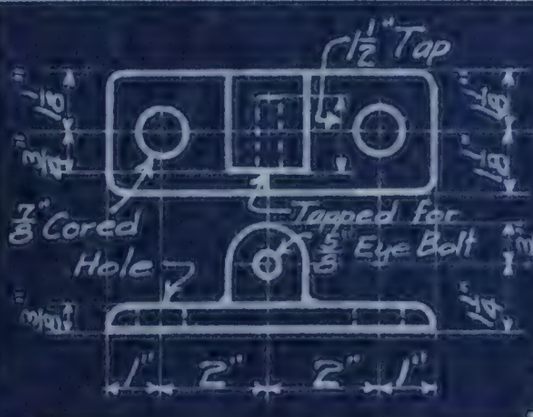


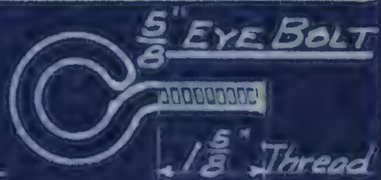
To be used on 8", 9", 10", 12", & 15" stringers.

SUGGESTIVE DETAILS OF BASES TO CHANNELS



	PIPE							
	1 1/4"		1 1/2"		2"		2 1/2"	
F	4		4		4 5/16		4 9/16	
G	2 1/16		2 3/4		3 1/8		3 5/8	
Patt Nº	A134		A135		A136		A137	
Wt.	5.0		5.4		5.7		6.0	





Make dims. of Eye Bolt to suit. Loop to have close fit on pipe.

Patt. Nº A138

Wt. 2.5*

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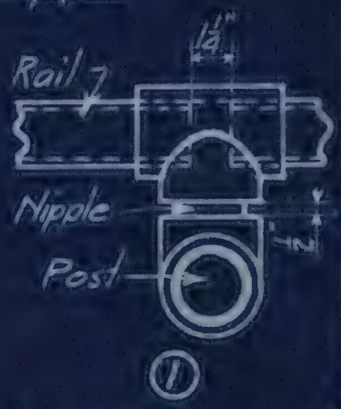
PIPE RAILING - GENERAL INFORMATION

To insure exact dimensions of Finished Railing, actual furnished lengths of fittings must be considered as the latter may vary appreciably from the Standards.

Distances C to C. of posts should always be given. Number each run of rail beginning with "R1" at a corner or otherwise and continuing in the order in which the railing is to be erected. Always state this order on complex railings for the guidance of pipe fitters and erectors.

Intermediate Tees and Crosses through which the rails pass are not threaded in the run. Rails are to be continuous through such fittings and adjacent sections coupled up to suit stock lengths of pipe.

Avoid the use of left threaded fittings. Railing should always be made so as to secure final closing without such fittings by cutting the bottom rail at a post so that at least a clearance of 1/4", for pipes up to 3" in dia., exists between the ends of the pipe. See Sketch ①.



①

(For convenience the Rail is shown Horizontal)

Where possible avoid the use of side outlet Ells and Tees. This can generally be accomplished by off setting the corner posts. Also, where possible, use Right Angle Ells and Tees which can generally be accomplished, on inclined railings, by off-setting the posts and using nipples.

The minimum clearance between fittings of post where nipples are used is 1/4" - preferably - 1/2".

Standard gas pipe threads are cut on a slight taper so that long threads can not be cut without making the ends of the pipe very thin. It is better not to specify threads longer than the standard thread.

With Standard Threads the pipe should be screwed into the fitting to insure a tight joint approximately the following distances —

Dia. of Pipe	Distance	Dia. of Pipe	Distance	Dia. of Pipe	Distance
1/4 - 3/8 - 1/2"	3/8"	2"	3/4"	7"	1 1/4"
3/4"	1/2"	2 1/2" - 3"	7/8"	8" - 9"	1 3/8"
1"	11/16"	3 1/2" - 4"	1"	10" - 11" - 12"	1 1/2"
1 1/4" - 1 1/2"	5/8"	5" - 6"	1 1/8"		

Where possible
"A" should not be less than 4'-6"
"B" " " " more " 8'-0"
nor less than 2'-0". In extreme cases these distances can be varied.

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C.A.D.'s Standard.
As Approved 1-25-17.

A.B.Co's Standard

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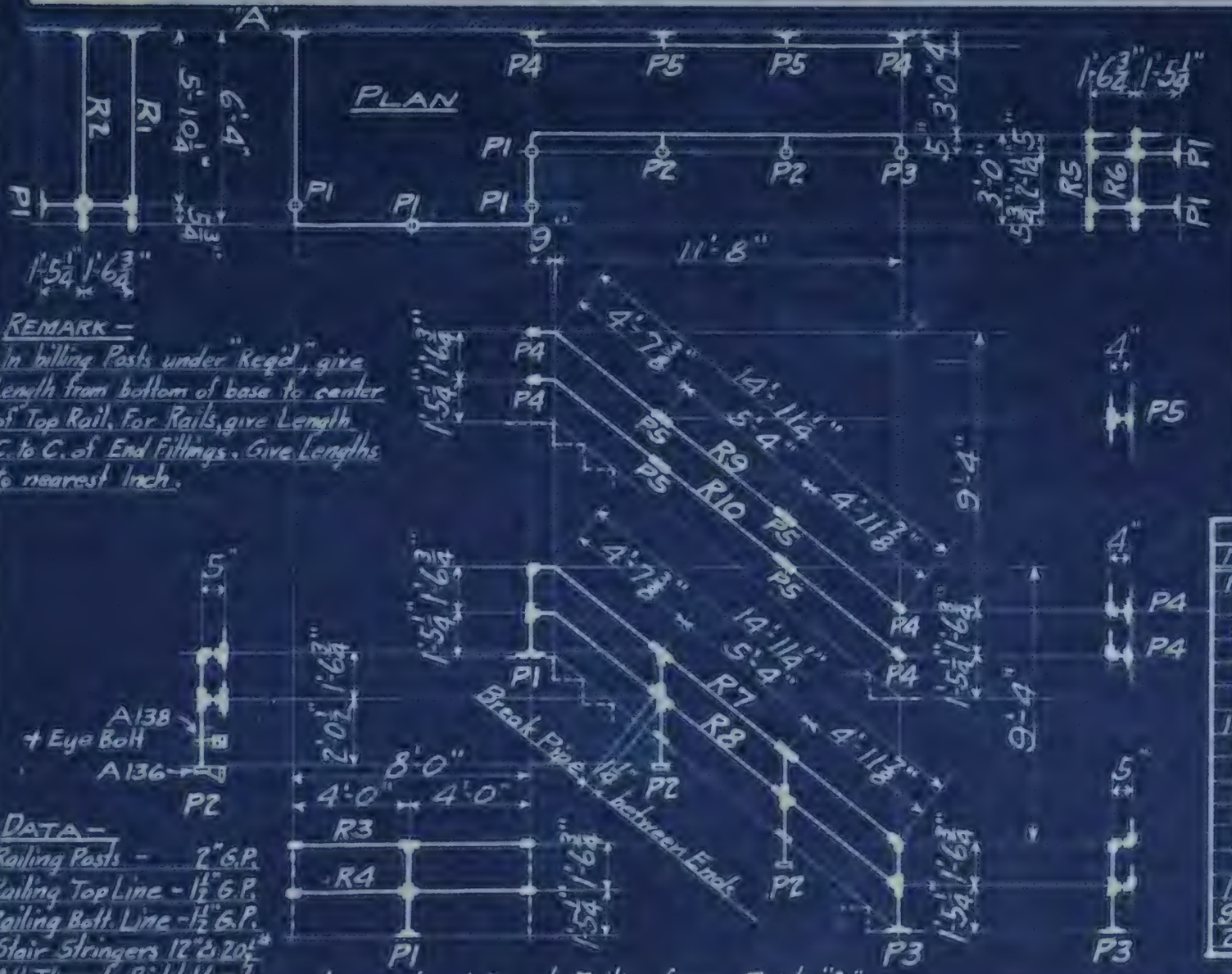

REMARK –

In billing Posts under "Reqd", give Length from bottom of base to center of Top Rail. For Rails, give Length C. to C. of End Fittings. Give Lengths to nearest Inch.

DATA –

Railing Posts – 2" G.P.
Railing Top Line – 1½" G.P.
Railing Bott. Line – 1½" G.P.
Stair Stringers 12" & 20½"
All Threads Right Hand.

Lay-out and Erect Railing from Point "A"

REQUIRED

No.	Mk.	Description	Dia.	Length
1	R1	Rail	1½"	6'-4"
1	R2	"	"	6'-4"
1	R3	"	"	8'-0"
1	R4	"	"	8'-0"
1	R5	"	"	3'-0"
1	R6	"	"	3'-0"
1	R7	"	"	15'-8"
1	R8	"	"	15'-8"
1	R9	"	"	15'-8"
1	R10	"	"	15'-8"
4	P1	Post (Assemble complete with Fittings)	2"	3'-0"
2	P2	"	"	3'-9"
1	P3	"	"	3'-0"
2	P4	Wall Brkt.	1½"	0'-4"
2	P5	" "	"	0'-4"
All Machine + Exp. Bolts and Lag Screws billed on Misc. Bolt Bill C –				

MATERIAL ORDER

No.	Mark	Description	Ord'd
10	A124	Bases with R1, R2, P4, P5	C-
1	A126	" " P3	C-
4	A131	" " P1	C-
2	A136	Brackets with P2	C-
2	A138	" " P2	C-
2	Eye Bolts with P2		C-
12	L3	Ells	
3	L4	"	
8	M664	Tees	
4	M668	"	
4	M690	"	
3	T4	"	
14	Nipples	1½"ø x 2" with P2, P3, P4, P5	
96	Net Lin. Ft.	1½"ø G.P. with Couplings	
21	" "	" 2"ø G.P. " "	

GAS PIPE RAILING

P9.164 b

- A.B.Co's Standard -

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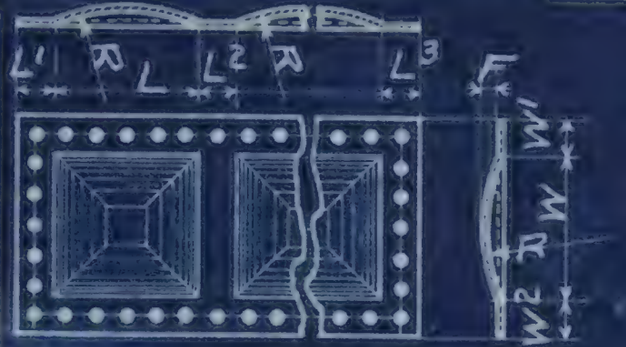
BUCKLED PLATES



Plates are steel 1/4", 5/16", 3/8", or 7/16" thick. If plates of greater length than given in the Table are required, they may be made by splicing with bars, angles or tees. Sketch for Buckled Pls. should indicate allowable over-run in length and width.

Unless otherwise ordered, all Pls. are made with buckles up. When buckles are turned down a drain hole should be punched in center of each buckle + should be shown on drawing. Buckles of diff. sizes should not be used in same pl. as it increases cost of Pl.

End flanges, L¹ + L3 to be made alike if possible - Min. 2" Max. 1'-6". If made wider than 1'-6", use angles riveted across pls for stiffs. Side Flanges, W¹, W², to be made alike if possible - Min. 2", Max. 6½" - 4" or less preferred. When side flanges are of unequal width, material should be ordered wide enough to make two flanges of greater width, the narrower flange to be sheared to reqd width after buckling. Die Nº must be shown on drawing.

For fillets, L² - Min. 2", Max. 6" - 4" or less preferred.

Connection holes are generally for 5/8", 3/4" or 7/8" rivets or bolts. Diff. sized holes in same Pl will increase cost of Pl. Spacing for holes lengthwise of Pl. should be in multiples of 3" and should not exceed 12". Odd spaces to be at end of Pl. and in even 1/4". Minimum spacing crosswise - 4½", usually 6".

Die Nº	Size of Buckle Side "L"	Side "W"	Rise F	Radii of Buckles For "L"	For "W"	Nº of Buckles in 1-Pl.
1	3'-11"	4'-6"	3½	6'-8 5/8"	8'-9 7/8"	1 to 8
2	4-6	3-11	"	8-9 7/8	6-8 5/8	" 7
3	3-11	3-6	3	7-9½	6-3	" 8
4	3-6	3-11	"	6-3	7-9½	" 9
5	3-9	3-9	"	7-1 7/8	7-1 7/8	" 8
6	3-1	"	"	4-10 5/8	7-1 7/8	" 10
7	3-9	3-1	"	7-1 7/8	4-10 5/8	" 8
8	3-8	3-8	2	10-2	10-2	" 8
9	2-8	"	"	5-5	"	" 11
10	3-8	2-8	"	10-2	5-5	" 8
11	2-2	3-8	"	3-7¼	10-2	" 14
12	3-8	2-2	"	10-2	3-7¼	" 8
13	3-0	3-0	"	6-10	6-10	" 10
14	2-9	2-9	3	3-10 7/8	3-10 7/8	" 11
19	2-6	"	2½	3-10¼	4-7 7/8	" 12

Die Nº	Size of Buckle Side "L"	Side "W"	Rise F	Radii of Buckles For "L"	For "W"	Nº of Buckles in 1-Pl.
20	2'-9"	2'-6"	2½	4'-7 7/8"	3'-10¼"	1 to 11
21	2-6	"	"	3-10¼	"	" 12
22	3-5	3-6	3	5-11 9/16	6-3	" 9
23	3-6	3-5	"	6-3	5-11 9/16	" 9
24	"	3-9	"	"	7-1 7/8	" 9
25	3-9	3-6	"	7-1 7/8	6-3	" 8
26	3-2	3-1	"	5-1 21/32	4-10 5/8	" 9
27	3-1	3-2	"	4-10 5/8	5-1 21/32	" 10
28	3-0	3-1	"	4-7½	4-10 5/8	" 10
29	3-1	3-0	"	4-10 5/8	4-7½	" 10
30	2-6	2-0	2½	3-10¼	2-6 1/16	" 12
31	2-0	2-6	"	2-6 1/16	3-10¼	" 15
32	5-6	3-6	3½	13-1 21/64	5-4¾	" 5
33	3-6	5-6	"	5-4¾	13-1 21/64	" 9
34	4-0	4-0	3	8-1½	8-1½	" 7

P12.011a

"U" PLATES WITH WASHERS

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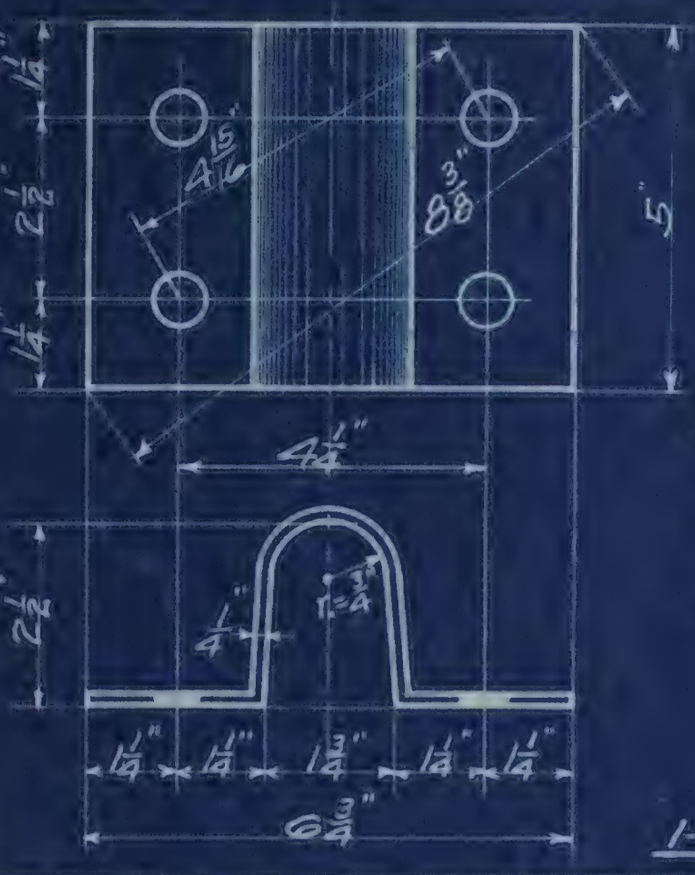
A.R.A. Cn's Standard
As Approved, 7-23-09.

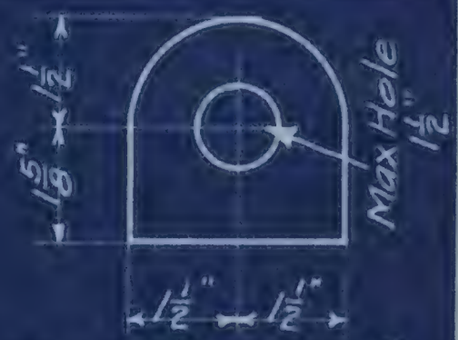
"U" PL. "A"
Wt. 3.9#

"U" Pl for rods up to $1\frac{1}{16}$" ϕ or $\frac{15}{16}$" □ (upset to $1\frac{3}{8}$")

1-Pl. 5" × $\frac{1}{4}$" - 0'-11"



Washer - Wt. 0.5#

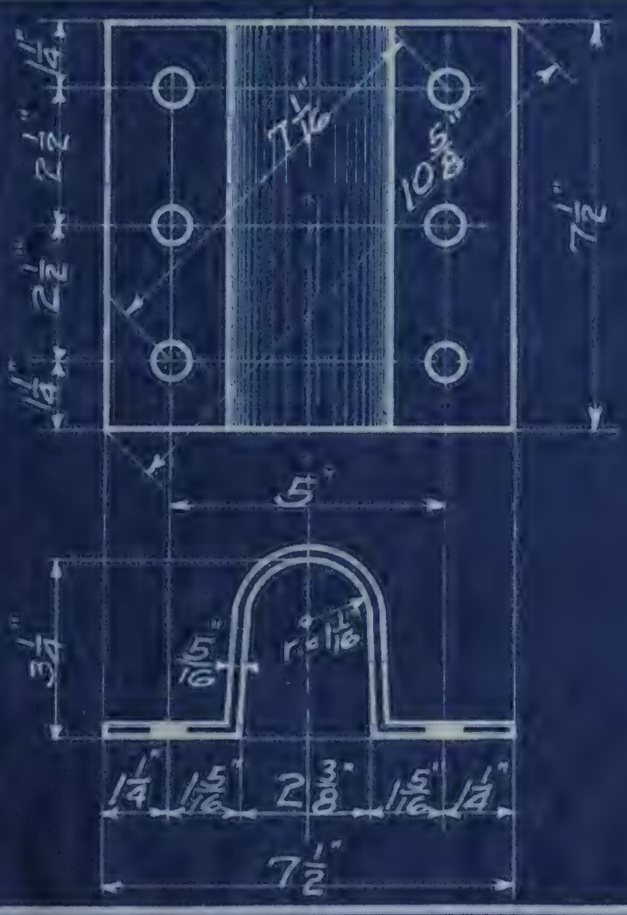


1-Pl. 3" × $\frac{1}{4}$" - 0'-3$\frac{1}{8}$"

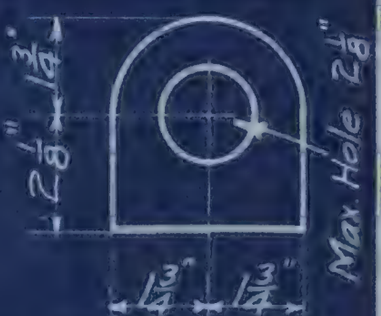
"U" PL. "B"
Wt. 8.6#

"U" Pl. for rods $1\frac{1}{8}$" ϕ or 1" □ (upset to $1\frac{1}{2}$" ϕ) up to $1\frac{5}{8}$" ϕ or $1\frac{3}{8}$" □ (upset to 2" ϕ).

1-Pl. 7½" × $\frac{5}{16}$" - 1'-1"



Washer - Wt. 1#



1-Pl. 3½" × $\frac{5}{16}$" - 0'-3$\frac{7}{8}$"

COOPER HITCH

PURLINS

Purlins or Girts should extend over two or more bays with joints staggered.

Where purlins act as struts, use clips with four holes.

Where purlins are punched for nailing strips, space holes abt. 3'-0" apart.

Bolt purlins to clips and clips to trusses unless otherwise specified.

Make due allowance in "P" + "H" for angles which overrun.

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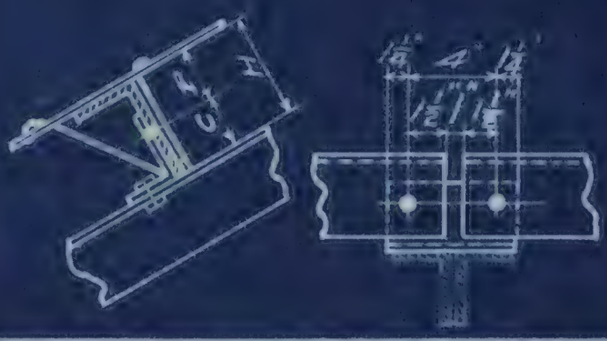
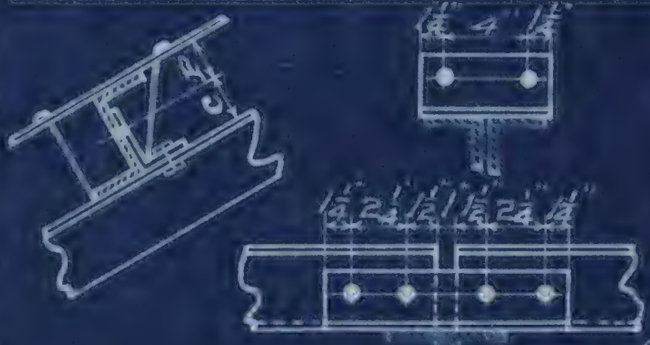
As Approved. 3-28-10.

ANGLE PURLINS



Leg of Purlin H	Clip Angle	P	C
2	1¾ × 1¾"	1	1
2½	2" × 2"	1⅜	1⅜
3	2½ × 2½ or 2"	1½	1½
3½	3" × 2½	1¾	1¾
4	3" × 2½	2	2
5	3½ × 2½	2½	2½

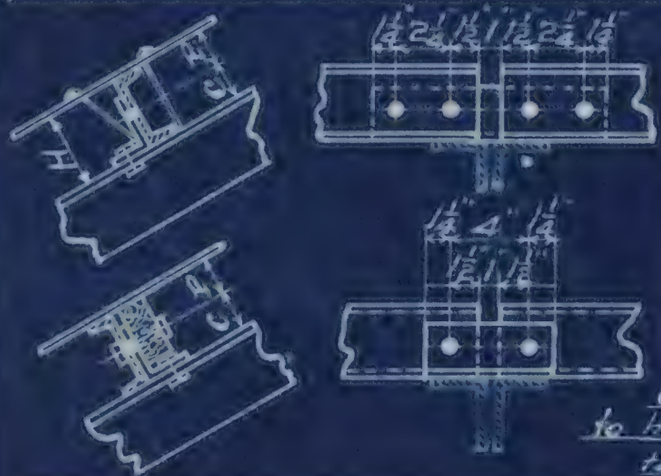
Z-BAR PURLINS



Purlin	Clip Angle	P	C
3	2½ × 2½ or 2"	1½	1½
4	3" × 2½	2	2
5	3½ × 2½"	2½	2½
6	4" × 3"	3	3

Z-Bars where used as struts or purlins, of 5" & over to have flange punched for connection to rafter

CHANNEL PURLINS

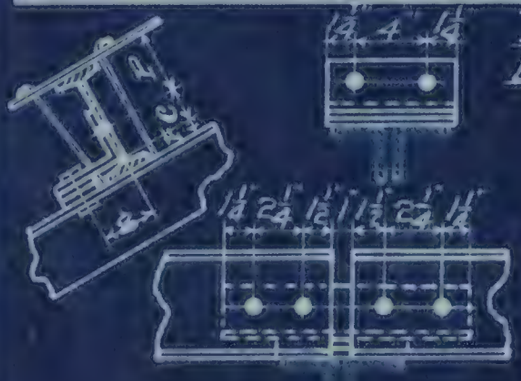


Purlin	Clip Angle	P	C
4	3" × 2½"	2	2
5	3½ × 2½"	2½	2½
6	4" × 3"	3	3
7	4" × 3"	4	3
8	4" × 3"	5	3
9	5" × 3½"	5½	3½
10	5" × 3½"	6½	3½

Channel Purlins over 7" deep to have flange also attached to rafters.

"I" beam purlins over 7" deep are usually bolted direct to rafter without clips.

I BEAM PURLINS



Purlin	Clip Angle	P	C	F	S
4	3½" × 2½	2	1¼	¾	2½
5	4" × 3"	2½	1¾	¾	2⅞
6	4" × 3"	3	2	1	3
7	5" × 3½	4	2	1	3½

C.S.J.A.R. 12-9-07

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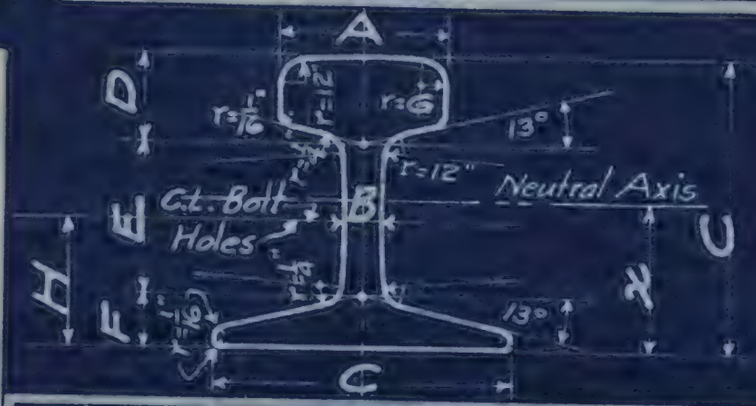


A.S.C.E. Rail Sections

Tan. 13° = 9.36336 or $2\frac{3}{4}$" in 12"

The Head contains 42%; Web, 21%; Base, 37% of the area of the section.

All dimensions are given in Inches.

Wt. per yd.	Area	Head A	Web B	Base + Ht. C	D	E	F	Radius G	H	Dist to Axis x	M. of Inertia I	Sect. Mod. S	Rad. Gyrat. r
100	9.8	$2\frac{3}{4}$	$\frac{9}{16}$	$5\frac{3}{4}$	$1\frac{45}{64}$	$3\frac{5}{64}$	$\frac{31}{32}$	$\frac{5}{16}$	$2\frac{65}{128}$	2.8	43.8	14.6	2.13
95	9.3	$2\frac{11}{16}$	"	$5\frac{9}{16}$	$1\frac{41}{64}$	$2\frac{63}{64}$	$\frac{15}{16}$	"	$2\frac{55}{128}$	2.7	38.6	13.3	2.06
90	8.8	$2\frac{5}{8}$	"	$5\frac{3}{8}$	$1\frac{19}{32}$	$2\frac{55}{64}$	$\frac{59}{64}$	"	$2\frac{45}{128}$	2.5	34.0	12.0	1.97
85	8.3	$2\frac{9}{16}$	"	$5\frac{3}{16}$	$1\frac{35}{64}$	$2\frac{3}{4}$	$\frac{57}{64}$	"	$2\frac{17}{64}$	2.5	30.0	11.0	1.90
80	7.8	$2\frac{1}{2}$	$\frac{35}{64}$	5	$1\frac{1}{2}$	$2\frac{5}{8}$	$\frac{7}{8}$	"	$2\frac{3}{16}$	2.4	26.2	10.0	1.83
75	7.4	$2\frac{15}{32}$	$\frac{17}{32}$	$4\frac{13}{16}$	$1\frac{27}{64}$	$2\frac{35}{64}$	$\frac{27}{32}$	"	$2\frac{15}{128}$	2.4	22.9	9.3	1.78
70	6.9	$2\frac{7}{16}$	$\frac{33}{64}$	$4\frac{5}{8}$	$1\frac{11}{32}$	$2\frac{15}{32}$	$\frac{13}{16}$	"	$2\frac{3}{64}$	2.2	19.6	8.2	1.70
65	6.4	$2\frac{13}{32}$	$\frac{1}{2}$	$4\frac{7}{16}$	$1\frac{9}{32}$	$2\frac{3}{8}$	$\frac{25}{32}$	"	$1\frac{31}{32}$	2.2	16.9	7.4	1.63
60	5.9	$2\frac{3}{8}$	$\frac{31}{64}$	$4\frac{1}{4}$	$1\frac{7}{32}$	$2\frac{17}{64}$	$\frac{49}{64}$	"	$1\frac{115}{128}$	2.1	14.5	6.7	1.58
55	5.4	$2\frac{1}{4}$	$\frac{15}{32}$	$4\frac{1}{16}$	$1\frac{1}{64}$	$2\frac{11}{64}$	$\frac{23}{32}$	"	$1\frac{103}{128}$	2.0	11.9	5.8	1.49
50	4.9	$2\frac{1}{8}$	$\frac{7}{16}$	$3\frac{7}{8}$	$1\frac{1}{8}$	$2\frac{1}{16}$	$\frac{11}{16}$	"	$1\frac{23}{32}$	1.9	9.8	4.9	1.42
45	4.4	2	$\frac{27}{64}$	$3\frac{11}{16}$	$1\frac{1}{16}$	$1\frac{31}{32}$	$\frac{21}{32}$	"	$1\frac{41}{64}$	1.8	8.0	4.2	1.35
40	3.9	$1\frac{7}{8}$	$\frac{25}{64}$	$3\frac{1}{2}$	$1\frac{1}{64}$	$1\frac{55}{64}$	$\frac{5}{8}$	"	$1\frac{71}{128}$	1.7	6.6	3.6	1.30
35	3.4	$1\frac{3}{4}$	$\frac{23}{64}$	$3\frac{5}{16}$	$\frac{61}{64}$	$1\frac{25}{32}$	$\frac{37}{64}$	"	$1\frac{15}{32}$	1.6	4.8	2.8	1.19
30	3.0	$1\frac{11}{16}$	$\frac{21}{64}$	$3\frac{1}{8}$	$\frac{7}{8}$	$1\frac{23}{32}$	$\frac{17}{32}$	"	$1\frac{25}{64}$	1.4	3.5	2.3	1.11
25	2.5	$1\frac{1}{2}$	$\frac{19}{64}$	$2\frac{3}{4}$	$\frac{25}{32}$	$1\frac{31}{64}$	$\frac{31}{64}$	$\frac{1}{4}$	$1\frac{29}{128}$	1.3	2.4	1.7	.99

R1.091 a

RIVETS

PROPORTIONS

$a = d \times 1.625$
$b = d \times 0.6906$
$e = d \times 1.0359$
$c = b$

Dia. of Shaft d	Dia. of Hole	Full Head				Countersunk	
		Diam. a	Height b	Radius c	Radius e	Diam. g	Depth f
1	1 1/16	1 5/8	11/16	1/2	1 1/32	1 3/16	3/8
7/8	15/16	1 7/16	39/64	29/64	57/64	1 3/8	11/32
3/4	13/16	1 1/4	17/32	13/32	51/64	1 5/16	5/16
5/8	11/16	1 1/16	29/64	23/64	43/64	1	9/32
1/2	9/16	7/8	3/8	3/16	9/16	25/32	1/4
3/8	7/16	11/16	19/64	11/64	7/16	19/32	3/16

MINIMUM RIVET SPACING

Size of Rivet	1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/8
Min. Distance	1	1 1/4	1 3/4	2	2 1/4	2 5/8	3	3 1/4

MINIMUM BUTTON SETS

D = 2" For 5/8" ϕ Rivet
= 2 1/4" " 3/4" ϕ "
= 2 1/2" " 7/8" ϕ "
= 2 3/4" " 1" ϕ "
= 3" " 1 1/8" ϕ "

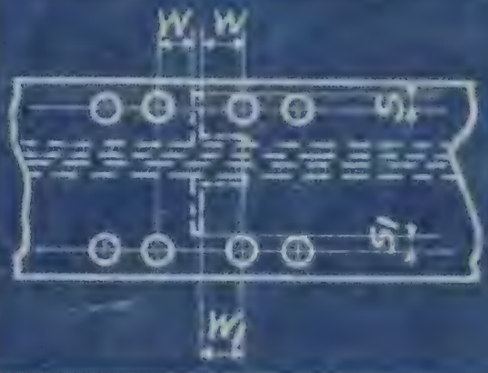
CLEARANCE FOR RIVETING

For 5/8" ϕ Riv. Std.	1 1/8"	3/8" Min.
" 3/4" ϕ " "	1 1/4"	1" "
" 7/8" ϕ " "	1 3/8"	1 1/8" "
" 1" ϕ " "	1 1/2"	1 1/4" "
" 1 1/8" ϕ " "	1 5/8"	1 3/8" "

RIVETS IN CRIMPED ANGLES

"b" = 1 1/2" + thickness of chord angles but never less than 2".

STANDARD CLEARANCE FOR COVER PLATE RIVETING



S	W	S1	W1
1/2	2 1/2	0	2 1/2
1	2 5/8	1/2	2 1/4
1 1/2	2 3/4	1	2 1/8
2	2 7/8	1 1/2	2
2 1/2	2 7/8	2	1 1/2
3	2 7/8	2 1/2	0
3 1/2	3		
4	3 1/8		
4 1/2	3 1/8		
5	3 1/4		
5 1/2	3 1/4		
6	3 3/8		

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R9.222 a

STAGGER OF RIVETS

DISTANCE C. to C. OF RIVETS

Values below or to right of upper zigzag line are large enough for ¾"ϕ Rivets. Values below or to right of lower zigzag line are large enough for ⅞"ϕ Rivets.

Values of "c" for Varying Values of "a" - "b"

b	Values of "a" in Inches													
Inches	⅞	1	1⅛	1¼	1⅜	1½	1⅝	1¾	1⅞	2	2⅛	2¼	2⅜	2½
1⅛	1 1/16	1½	1 11/16	1 15/16	1¾	1 13/16	2	2 1/16	2 3/16	2 5/16	2⅜	2 7/16	2½	2 9/16
1¼	1 3/16	1⅜	1 15/16	1¾	1 13/16	1 15/16	2 1/16	2⅛	2 3/16	2 5/16	2⅜	2 7/16	2½	2 9/16
1⅜	1 5/16	1 11/16	1¾	1 13/16	1 15/16	2	2⅛	2 3/16	2 5/16	2⅜	2 7/16	2½	2 9/16	2⅝
1½	1⅜	1 13/16	1 15/16	2	2⅛	2 3/16	2 5/16	2⅜	2 7/16	2½	2 9/16	2⅝	2 11/16	2¾
1⅝	1 7/16	1 15/16	2	2 1/16	2⅛	2 3/16	2 5/16	2⅜	2½	2 9/16	2⅝	2 11/16	2¾	2 13/16
1¾	1½	2	2 1/16	2⅛	2 3/16	2 5/16	2⅜	2 7/16	2½	2 9/16	2⅝	2 11/16	2¾	2 13/16
1 13/16	1 9/16	2 1/16	2⅛	2 3/16	2 5/16	2⅜	2 7/16	2½	2 9/16	2⅝	2 11/16	2¾	2 13/16	2 15/16
1⅞	1 5/8	2⅛	2 3/16	2 5/16	2⅜	2 7/16	2½	2 9/16	2⅝	2 11/16	2¾	2 13/16	2 15/16	3
2	1 11/16	2 3/16	2 5/16	2⅜	2 7/16	2½	2 9/16	2⅝	2 11/16	2¾	2 13/16	2 15/16	3	3 1/16
2⅛	1¾	2 5/16	2⅜	2 7/16	2½	2 9/16	2⅝	2 11/16	2¾	2 13/16	2 15/16	3	3 1/16	3⅛
2¼	1 13/16	2⅜	2 7/16	2½	2 9/16	2⅝	2 11/16	2¾	2 13/16	2 15/16	3	3 1/16	3⅛	3 3/16
2⅜	1 15/16	2 7/16	2½	2 9/16	2⅝	2 11/16	2¾	2 13/16	2 15/16	3	3 1/16	3⅛	3 3/16	3¼
2½	2	2½	2 9/16	2⅝	2 11/16	2¾	2 13/16	2 15/16	3	3 1/16	3⅛	3 3/16	3¼	3 5/16

MINIMUM FOR NET SECTION

Two Holes out

One Hole cut

⅝" ϕ rivets can be taken at ⅛" less than for ¾" ϕ rivets

1" ϕ rivets can be taken at ⅛" more than for ⅞" ϕ rivets

$a - 2y = \sqrt{a^2 + b^2} - 3y$

$b = \sqrt{2ay + y^2}$

$a - y = \sqrt{a^2 + b^2} - 2y$

$b = \sqrt{2ay + y^2}$

y = Diam. of Rivet + ⅛"

Sum of Gauges a.	b in Inches	
	¾" ϕ Rivet	⅞" ϕ Rivet
1	1 5/8	1 3/4
1½	1 7/8	2
2	2 1/16	2 1/4
2½	2 1/4	2 7/16
3	2 7/16	2 5/8
3½	2 5/8	2 13/16
4	2 13/16	3
4½	2 15/16	3 3/16

Sum of Gauges a.	b in Inches	
	¾" ϕ Rivet	⅞" ϕ Rivet
5	3 1/16	3 5/16
5½	3 1/4	3 1/2
6	3 3/8	3 5/8
6½	3 1/2	3 3/4
7	3 5/8	3 7/8
7½	3 3/4	4
8	3 7/8	4 1/8
8½	4	4 1/4

MINIMUM FOR CLEARANCE

"b" in Inches for Varying Values of "c" for Min. Values of "d"

Rivet	¾" ϕ	⅞" ϕ	1" ϕ	1⅛" ϕ
c \ d	1⅛"	1¼"	1⅜"	1½"
1 3/8"	¾	1 1/16"	1 5/16"	1 9/16"
1 7/16"	0	1 1/16"	1 5/16"	1 9/16"
1 3/4"		5/8"	1 1/8"	1 1/2"
1 13/16"		7/16"	1"	1 3/8"
1 7/8"		0	7/8"	1 5/16"
1 15/16"			3/4"	1 1/4"
2 1/16"			0	1"
2 3/16"				11/16"
2 5/16"				0

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Is Approved: 6-12-07.
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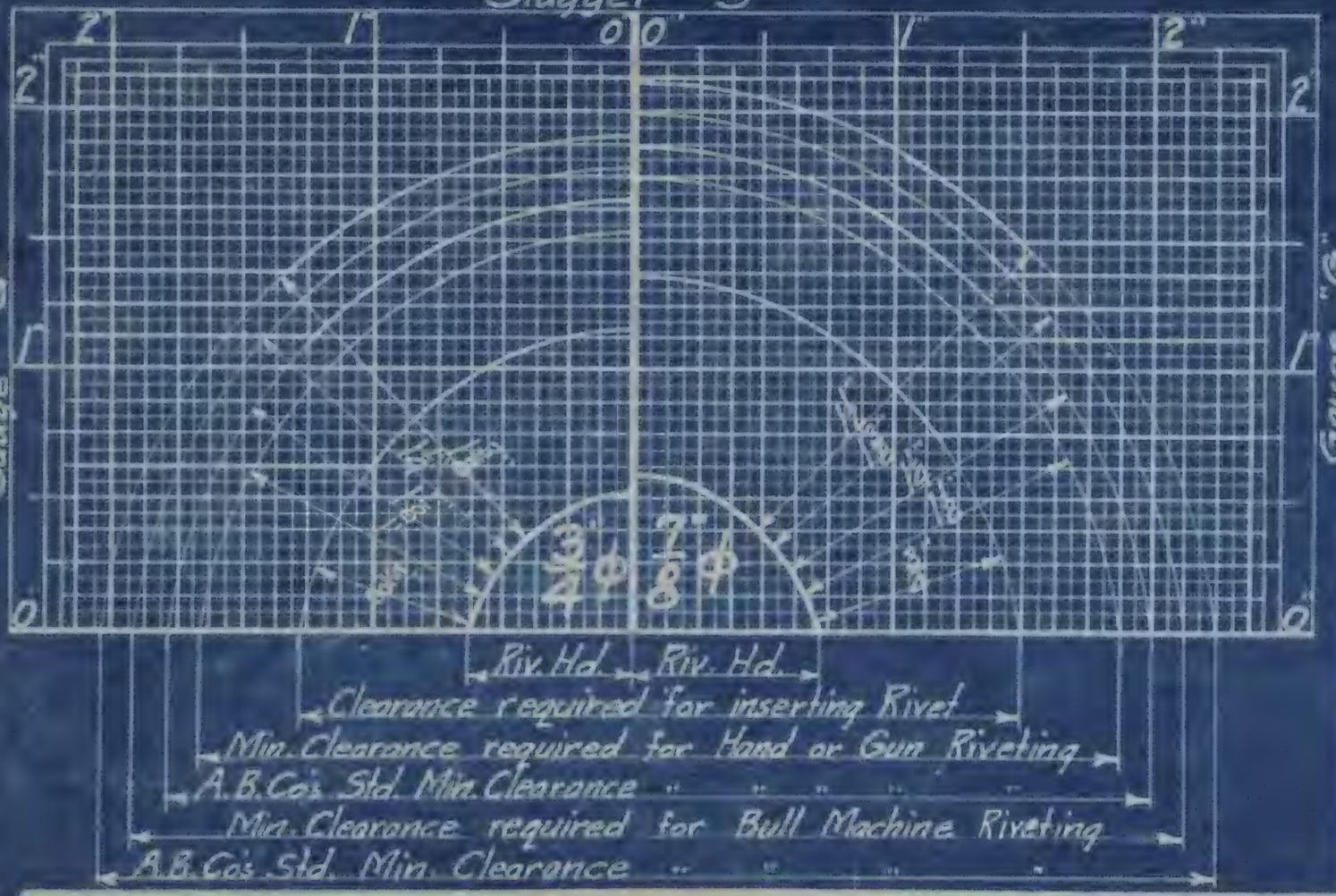
CLEARANCES REQUIRED FOR DRIVING STAGGERED RIVETS



Field Rivets

Two Full Heads
Countersunk near side
Countersunk far side
Countersunk both sides

Shop Rivets

Two Full Heads
Countersunk near side
Countersunk far side
Countersunk both sides

Flathead or Cone not chipped

- near side
- far side
- both sides

Flathead or Cone chipped

⅝" & ¾" Rivets

- near side
- far side
- both sides

⅞" & 1" Rivets

- near side
- far side
- both sides

CONVENTIONAL SIGNS FOR RIVETING

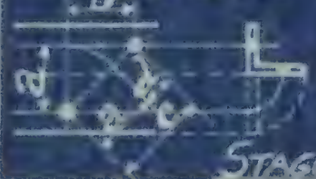
R9.222 b

Stagger of Rivets in Tension Members to Maintain Net Section

using the Excess of Metal in Member over that Required.

Metal Values — Using 16000# per Sq. Inch. (Thousands of lbs.

Thickness	"E" Width of Metal																	
	1/16	1/8	3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	13/16	7/8	15/16	1	1 1/16	1 1/8
1/16	0.07	0.13	0.19	0.25	0.32	0.38	0.44	0.50	0.57	0.63	0.69	0.75	0.82	0.88	0.94	1.00	1.07	1.13
1/8	0.13	0.25	0.38	0.50	0.63	0.75	0.88	1.00	1.13	1.25	1.38	1.50	1.63	1.75	1.88	2.00	2.13	2.25
3/16	0.19	0.38	0.57	0.75	0.94	1.13	1.32	1.50	1.69	1.88	2.07	2.25	2.44	2.63	2.82	3.00	3.19	3.38
1/4	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.50
5/16	0.32	0.63	0.94	1.25	1.57	1.88	2.19	2.50	2.82	3.13	3.44	3.75	4.07	4.38	4.69	5.00	5.32	5.63
3/8	0.38	0.75	1.13	1.50	1.88	2.25	2.63	3.00	3.38	3.75	4.13	4.50	4.88	5.25	5.63	6.00	6.38	6.75
7/16	0.44	0.88	1.32	1.75	2.19	2.63	3.07	3.50	3.94	4.38	4.82	5.25	5.69	6.13	6.57	7.00	7.44	7.88
1/2	0.50	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.50	6.00	6.50	7.00	7.50	8.00	8.50	9.00
9/16	0.57	1.13	1.69	2.25	2.82	3.38	3.94	4.50	5.07	5.63	6.19	6.75	7.32	7.88	8.44	9.00	9.57	10.13
5/8	0.63	1.25	1.88	2.50	3.13	3.75	4.38	5.00	5.63	6.25	6.88	7.50	8.13	8.75	9.38	10.00	10.63	11.25
3/4	0.75	1.50	2.25	3.00	3.75	4.50	5.25	6.00	6.75	7.50	8.25	9.00	9.75	10.50	11.25	12.00	12.75	13.50



In Table of Metal Values" find "E" width of metal corresponding to the Excess of "Available Stress" over "Actual Stress" for a given Member. Subtracting this from size of Hole used gives "d". Under d and given "a" find "b". Example:- Take 3"x1"x⅜" ∠. a=3½" Stress = 12000# Available Stress (one ⅞" Hole out) = 15000#. E = 1½" a-2=3½-d ∴ b = 1⅝"

Stagger "b" Required to gain "d" in Section.

Size of ∠s	"a"	"d" = Dia. of Hole or Dia. of Hole - "E" for the Excess Stress.																
		1/16	1/8	3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	13/16	7/8	15/16	1	1 1/16	1 1/8
	1½"	7/16	5/8	13/16	15/16	1 1/16	1 1/8	1 1/4	1 3/8	1 7/16	1 9/16	1 5/8	1 11/16	1 13/16	1 7/8	1 15/16	2	2 1/8	2 3/16
	1¾	1/2	11/16	7/8	1	1 1/8	1 1/4	1 5/16	1 1/16	1 9/16	1 5/8	1 3/4	1 13/16	1 7/8	2	2 1/16	2 1/8	2 3/16
	2	1/2	3/4	15/16	1 1/16	1 3/16	1 5/16	1 7/16	1 1/2	1 5/8	1 3/4	1 13/16	1 15/16	2	2 1/8	2 3/16	2 1/4	2 3/8	2 7/16
2"x2"	2¼	3/8	13/16	15/16	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 11/16	1 13/16	1 15/16	2	2 1/8	2 3/16	2 5/16	2 3/8	2 7/16	2 9/16
2½"x2"	2½	5/8	13/16	1	1 3/16	1 5/16	1 7/16	1 9/16	1 11/16	1 13/16	1 7/8	2	2 1/8	2 3/16	2 5/16	2 3/8	2 1/2	2 9/16	2 5/8
2½"x2½"	2¾	5/8	7/8	1 1/16	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	1 7/8	2	2 1/16	2 1/16	2 5/16	2 3/8	2 1/2	2 9/16	2 11/16	2 3/4
3"x2"	2⅞	5/8	7/8	1 1/16	1 1/4	1 3/8	1 9/16	1 11/16	1 13/16	1 15/16	2	2 1/8	2 1/4	2 5/16	2 7/16	2 9/16	2 5/8	2 3/4	2 15/16
3"x2½"	3⅛	5/8	15/16	1 1/8	1 5/16	1 7/16	1 5/8	1 3/4	1 7/8	2	2 1/8	2 3/16	2 5/16	2 7/16	2 1/2	2 5/8	2 3/4	2 13/16	2 15/16
3½"x2½"	3⅜	11/16	15/16	1 3/16	1 3/8	1 1/2	1 11/16	1 13/16	1 15/16	2 1/16	2 3/16	2 5/16	2 3/8	2 1/2	2 5/8	2 11/16	2 13/16	2 15/16	3
3"x3"	3½	11/16	1	1 3/16	1 3/8	1 9/16	1 11/16	1 13/16	1 15/16	2 1/16	2 3/16	2 5/16	2 7/16	2 9/16	2 5/8	2 3/4	2 7/8	2 15/16	3 1/16
3½"x3"	3¾	11/16	1	1 1/4	1 7/16	1 9/16	1 3/4	1 7/8	2	2 3/16	2 5/16	2 3/8	2 1/2	2 5/8	2 3/4	2 13/16	2 15/16	3 1/16	3 1/8
3½"x3½"	4	3/4	1 1/16	1 1/4	1 7/16	1 5/8	1 13/16	1 15/16	2 1/16	2 1/4	2 3/8	2 1/2	2 9/16	2 11/16	2 13/16	2 15/16	3	3 1/8	3 1/4
4"x3"	4¼	3/4	1 1/16	1 5/16	1 1/2	1 11/16	1 7/8	2	2 1/8	2 5/16	2 7/16	2 3/16	2 11/16	2 3/4	2 7/8	3	3 1/8	3 3/16	3 5/16
	4½	3/4	1 1/8	1 5/16	1 1/2	1 3/4	1 7/8	2 1/16	2 3/16	2 3/8	2 1/2	2 5/8	2 3/4	2 7/8	3	3 1/16	3 3/16	3 5/16	3 7/16
	4¾	13/16	1 1/8	1 5/16	1 9/16	1 11/16	1 15/16	2 1/16	2 1/4	2 7/16	2 9/16	2 11/16	2 13/16	2 15/16	3 1/16	3 3/16	3 1/4	3 3/8	3 1/2
	5	13/16	1 1/8	1 7/16	1 5/8	1 13/16	2	2 1/16	2 5/16	2 7/16	2 5/8	2 3/4	2 7/8	3	3 1/8	3 1/4	3 3/8	3 7/16	3 9/16
	5¼	13/16	1 3/16	1 7/16	1 11/16	1 13/16	2 1/16	2 3/16	2 3/8	2 1/2	2 11/16	2 13/16	2 15/16	3 1/16	3 3/16	3 5/16	3 7/16	3 9/16	3 5/8
	5½	13/16	1 3/16	1 7/16	1 11/16	1 7/8	2 1/16	2 1/4	2 7/16	2 5/8	2 11/16	2 13/16	3	3 1/8	3 1/16	3 3/8	3 7/16	3 5/8	3 11/16
	5¾	7/8	1 1/4	1 1/2	1 11/16	1 15/16	2 1/8	2 5/16	2 1/2	2 5/8	2 3/4	2 7/8	3 1/16	3 3/16	3 5/16	3 7/16	3 1/2	3 11/16	3 13/16
	6	7/8	1 1/4	1 1/2	1 3/4	2	2 1/8	2 5/16	2 1/2	2 11/16	2 13/16	3	3 1/8	3 1/4	3 3/8	3 1/2	3 5/8	3 3/4	3 7/8

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N.P.F.

Areas to be Deducted for Rivet Holes

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Areas for 1-Hole Deductions

Thickness of Metal	Size of Rivets				
	1/2" ϕ	5/8" ϕ	3/4" ϕ	7/8" ϕ	1" ϕ
1/16	.0391	.0469	.0547	.0625	.0703
1/8	.0781	.0938	.1094	.1250	.1406
3/16	.1172	.1406	.1641	.1875	.2109
1/4	.1563	.1876	.2188	.2500	.2813
5/16	.1953	.2344	.2734	.3125	.3516
3/8	.2344	.2813	.3281	.3750	.4219
7/16	.2734	.3281	.3828	.4375	.4922
1/2	.3125	.3750	.4375	.5000	.5625
9/16	.3516	.4219	.4922	.5625	.6328
5/8	.3906	.4688	.5469	.6250	.7031
11/16		.5156	.6016	.6875	.7734
3/4		.5625	.6563	.7500	.8438
13/16			.7109	.8125	.9141
7/8			.7656	.8750	.9844
15/16				.9375	1.0547
1"				1.0000	1.1250

Area = (diam. of rivet + 1/8") x thickness of metal.
Area is given in sq. inches.

Areas for 2-Hole Deductions

Thickness of Metal	Size of Rivets				
	1/2" ϕ	5/8" ϕ	3/4" ϕ	7/8" ϕ	1" ϕ
1/16	.0782	.0938	.1094	.1250	.1406
1/8	.1562	.1876	.2188	.2500	.2812
3/16	.2344	.2812	.3282	.3750	.4218
1/4	.3126	.3750	.4376	.5000	.5626
5/16	.3906	.4688	.5469	.6250	.7032
3/8	.4688	.5626	.6562	.7500	.8438
7/16	.5468	.6562	.7656	.8750	.9844
1/2	.6250	.7500	.8750	1.0000	1.1250
9/16	.7032	.8438	.9844	1.1250	1.2656
5/8	.7812	.9376	1.0938	1.2500	1.4062
11/16		1.0312	1.2032	1.3750	1.5468
3/4		1.1250	1.3126	1.5000	1.6876
13/16			1.4218	1.6250	1.8282
7/8			1.5312	1.7500	1.9688
15/16				1.8750	2.1094
1"				2.0000	2.2500

R9.225 a

Rivet Lengths

Button Head

Grip	1/2"		5/8"		3/4"		7/8"		1"	
	l	Wt. per 100	l	Wt. per 100	l	Wt. per 100	l	Wt. per 100	l	Wt. per 100
1/2	1 1/2	14.2	1 3/4	26.3	1 7/8	37.1	2	56.7	2 1/8	86.3
5/8	1 5/8	14.8	1 7/8	27.4	2	38.6	2 1/8	58.8	2 1/4	88.8
3/4	1 3/4	15.5	2	28.5	2 1/8	40.1	2 1/4	60.9	2 3/8	91.9
7/8	1 7/8	16.2	2 1/8	29.6	2 1/4	41.8	2 3/8	63.1	2 1/2	94.6
1	2	16.9	2 1/4	30.6	2 3/8	43.3	2 1/2	65.2	2 5/8	97.4
1 1/8	2 1/8	17.6	2 3/8	31.7	2 1/2	44.9	2 5/8	67.3	2 3/4	100.2
1 1/4	2 1/4	18.3	2 1/2	32.8	2 5/8	46.5	2 3/4	69.6	2 7/8	103.0
1 3/8	2 3/8	19.0	2 5/8	33.9	2 3/4	48.0	2 7/8	71.6	3	105.0
1 1/2	2 5/8	20.4	2 7/8	36.1	3	51.2	3 1/8	75.8	3 1/4	111.3
1 5/8	2 3/4	21.1	3	37.2	3 1/8	52.7	3 1/4	78.0	3 3/8	114.1
1 3/4	3	22.5	3 1/4	39.4	3 3/8	55.8	3 1/2	82.2	3 5/8	119.7
1 7/8	3 1/8	23.2	3 3/8	40.4	3 1/2	57.4	3 5/8	84.4	3 3/4	122.4
2	3 1/4	23.9	3 1/2	41.5	3 5/8	59.0	3 3/4	85.5	3 7/8	125.1
2 1/8	3 3/8	24.6	3 5/8	42.6	3 3/4	60.5	3 7/8	88.6	4	128.0
2 1/4	3 1/2	25.3	3 3/4	43.7	3 7/8	62.1	4	90.8	4 1/8	130.8
2 3/8	3 5/8	26.0	3 7/8	44.8	4	63.7	4 1/8	92.9	4 1/4	133.6
2 1/2	3 3/4	26.7	4	45.9	4 1/8	65.2	4 1/4	95.0	4 3/8	136.4
2 5/8	3 7/8	27.4	4 1/8	47.0	4 1/4	66.8	4 3/8	97.1	4 1/2	139.0
2 3/4	4	28.1	4 1/4	48.0	4 3/8	68.4	4 1/2	99.3	4 5/8	141.9
2 7/8	4 1/8	28.7	4 3/8	49.1	4 1/2	69.9	4 5/8	101.4	4 3/4	145.0
3	4 3/8	30.1	4 5/8	51.3	4 3/4	73.1	4 7/8	105.6	5	150.0
3 1/8	4 1/2	30.8	4 3/4	52.4	4 7/8	74.6	5	107.8	5 1/8	153.0
3 1/4	4 5/8	31.5	4 7/8	53.5	5	76.2	5 1/8	109.9	5 1/4	155.8
3 3/8	4 3/4	32.2	5	54.6	5 1/8	77.8	5 1/4	112.0	5 3/8	158.6
3 1/2	4 7/8	32.9	5 1/8	55.6	5 1/4	79.3	5 3/8	114.2	5 1/2	161.4
3 5/8	5	33.6	5 1/4	56.7	5 3/8	80.9	5 1/2	116.3	5 5/8	164.2
3 3/4	5 1/8	34.3	5 3/8	57.8	5 1/2	82.4	5 5/8	118.4	5 3/4	167.0
3 7/8	5 1/4	35.0	5 1/2	58.9	5 5/8	84.0	5 3/4	120.6	5 7/8	169.7
4	5 3/8	35.7	5 5/8	60.0	5 3/4	85.6	5 7/8	122.7	6	172.5
4 1/8	5 5/8	36.8	5 7/8	62.2	6	88.6	6 1/8	126.9	6 1/4	178.1
4 1/4	5 3/4	37.8	6	63.3	6 1/8	90.3	6 1/4	129.1	6 3/8	180.9
4 3/8	6	39.2	6 1/4	65.5	6 3/8	93.4	6 1/2	133.3	6 5/8	186.5
4 1/2	6 1/8	39.9	6 3/8	66.6	6 1/2	95.1	6 5/8	135.4	6 3/4	189.2
4 5/8	6 1/4	40.6	6 1/2	67.6	6 5/8	96.5	6 3/4	137.6	6 7/8	192.0
4 3/4	6 3/8	41.3	6 5/8	68.7	6 3/4	98.1	6 7/8	139.7	7	194.8
4 7/8	6 1/2	42.0	6 3/4	69.8	6 7/8	99.7	7	141.9	7 1/8	197.6
5	6 5/8	42.7	6 7/8	70.9	7	101.2	7 1/8	144.0	7 1/4	200.3
5 1/8					7 1/8	102.8	7 1/4	146.1	7 3/8	203.1
5 1/4					7 1/4	104.4	7 3/8	148.2	7 1/2	205.9
5 3/8					7 3/8	105.9	7 1/2	150.4	7 5/8	208.7
5 1/2					7 5/8	108.9	7 3/4	154.7	7 7/8	214.3
5 5/8					7 3/4	111.0	7 7/8	156.8	8	217.0
5 3/4					7 7/8	112.5	8	159.0	8 1/8	219.8
5 7/8					8	114.0	8 1/8	161.1	8 1/4	222.6
6					8 1/8	115.5	8 1/4	163.2	8 3/8	225.4

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R9.225 b

RIVET LENGTHS
COUNTERSUNK HEAD

Grip	1/2"		5/8"		3/4"		7/8"		1"	
	l	Wt. per 100	l	Wt. per 100	l	Wt. per 100	l	Wt. per 100	l	Wt. per 100
1/2	1 1/8	12.2	1 1/4	22.0	1 1/4	29.3	1 3/8	46.1	1 3/8	69.6
5/8	1 1/4	12.8	1 3/8	23.1	1 3/8	30.9	1 1/2	48.2	1 1/2	72.2
3/4	1 3/8	13.4	1 1/2	24.1	1 1/2	32.4	1 5/8	50.3	1 5/8	74.6
7/8	1 1/2	14.2	1 5/8	25.2	1 5/8	34.0	1 3/4	52.5	1 3/4	77.7
1	1 5/8	14.8	1 3/4	26.3	1 3/4	35.5	1 7/8	54.6	1 7/8	80.7
1 1/8	1 3/4	15.5	1 7/8	27.4	1 7/8	37.1	2	56.7	2	83.3
1 1/4	1 7/8	16.2	2	28.5	2	38.6	2 1/8	58.8	2 1/8	86.3
1 3/8	2	16.9	2 1/8	29.6	2 1/8	40.1	2 1/4	61.0	2 1/4	88.8
1 1/2	2 1/8	17.6	2 1/4	30.6	2 3/8	43.3	2 3/8	63.1	2 1/2	94.6
1 5/8	2 1/4	18.3	2 3/8	31.7	2 1/2	44.9	2 1/2	65.2	2 5/8	97.4
1 3/4	2 1/2	19.7	2 5/8	33.9	2 3/4	48.0	2 3/4	69.5	2 7/8	103.0
1 7/8	2 5/8	20.4	2 3/4	35.0	2 7/8	49.6	2 7/8	71.6	3	105.0
2	2 3/4	21.1	2 7/8	36.1	3	51.2	3	73.7	3 1/8	108.5
2 1/8	2 7/8	21.8	3	37.2	3 1/8	52.7	3 1/8	75.9	3 1/4	111.3
2 1/4	3	22.5	3 1/8	38.3	3 1/4	54.3	3 1/4	78.0	3 3/8	114.1
2 3/8	3 1/8	23.2	3 1/4	39.4	3 3/8	55.8	3 3/8	80.1	3 1/2	116.9
2 1/2	3 1/4	23.9	3 3/8	40.4	3 1/2	57.4	3 1/2	82.3	3 5/8	119.7
2 5/8	3 3/8	24.6	3 1/2	41.5	3 5/8	59.0	3 5/8	84.4	3 3/4	122.4
2 3/4	3 1/2	25.3	3 5/8	42.6	3 3/4	60.5	3 3/4	86.5	3 7/8	125.1
2 7/8	3 5/8	26.0	3 3/4	43.7	3 7/8	62.1	3 7/8	88.6	4	128.0
3	3 7/8	27.4	4	45.9	4	63.7	4 1/8	92.9	4 1/4	133.6
3 1/8	4	28.1	4 1/8	47.0	4 1/8	65.2	4 1/4	95.0	4 3/8	136.4
3 1/4	4 1/8	28.7	4 1/4	48.0	4 1/4	66.8	4 3/8	97.2	4 1/2	139.0
3 3/8	4 1/4	29.4	[illegible]	[illegible]	[illegible]	[illegible]	4 1/2	99.3	4 5/8	141.9
3 1/2	4 3/8	30.1	4 1/2	50.2	4 1/2	69.9	[illegible]	[illegible]	[illegible]	[illegible]
3 5/8	4 1/2	30.8	4 5/8	51.3	4 5/8	71.5	4 3/4	103.5	4 7/8	147.5
3 3/4	4 5/8	31.5	4 3/4	52.4	4 3/4	73.1	4 7/8	105.7	5	150.0
3 7/8	4 3/4	32.2	4 7/8	53.5	4 7/8	74.6	5	107.8	5 1/8	153.2
4	4 7/8	32.9	5	54.6	5	76.2	5 1/8	109.9	5 1/4	155.8
4 1/8	5 1/8	34.3	5 1/4	56.7	5 1/4	79.3	5 3/8	114.2	5 1/2	161.4
4 1/4	5 1/4	35.0	5 3/8	57.8	5 3/8	80.9	5 1/2	116.3	5 5/8	164.2
4 3/8	5 1/2	36.4	5 5/8	60.0	5 5/8	84.0	5 5/8	118.4	5 3/4	167.0
4 1/2	5 5/8	37.1	5 3/4	61.1	5 3/4	85.6	5 3/4	120.6	5 7/8	169.7
4 5/8	5 3/4	37.8	5 7/8	62.2	5 7/8	87.1	5 7/8	122.7	6	172.5
4 3/4	5 7/8	38.5	6	63.3	6	88.6	6	124.8	6 1/8	175.3
4 7/8	6	39.2	6 1/8	64.4	6 1/8	90.3	6 1/8	126.9	6 1/4	178.1
5	6 1/8	39.9	6 1/4	65.5	6 1/4	91.8	6 1/4	129.1	6 3/8	180.9
5 1/8					6 3/8	93.4	6 3/8	131.2	6 1/2	184.0
5 1/4					6 1/2	95.1	6 1/2	133.4	6 5/8	186.5
5 3/8					6 5/8	96.5	6 5/8	135.5	6 3/4	189.2
5 1/2					6 7/8	99.7	6 7/8	139.8	7	194.8
5 5/8					7	101.2	7	142.0	7 1/8	197.6
5 3/4					7 1/8	102.8	7 1/8	144.1	7 1/4	200.3
5 7/8					7 1/4	104.4	7 1/4	146.2	7 3/8	203.1
6					7 3/8	105.9	7 3/8	148.3	7 1/2	205.9

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No Spcs	Pitch in Inches															No Spcs
	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	1 7/8	2	2 1/8	2 1/4	2 3/8	2 1/2	2 5/8	2 3/4	2 7/8	
1																1
2	2 1/4	2 1/2	2 3/4	3	3 1/4	3 1/2	3 3/4	4	4 1/4	4 1/2	4 3/4	5	5 1/4	5 1/2	5 3/4	2
3	3 3/8	3 3/4	4 1/8	4 1/2	4 7/8	5 1/4	5 5/8	6	6 3/8	6 3/4	7 1/8	7 1/2	7 7/8	8 1/4	8 5/8	3
4	4 1/2	5	5 1/2	6	6 1/2	7	7 1/2	8	8 1/2	9	9 1/2	10	10 1/2	11	11 1/2	4
5	5 5/8	6 1/4	6 7/8	7 1/2	8 1/8	8 3/4	9 3/8	10	10 5/8	11 1/4	11 7/8	1-0 1/2	1-1 1/8	1-1 3/4	1-2 3/8	5
6	6 3/4	7 1/2	8 1/4	9	9 3/4	10 1/2	11 1/4	1-0	1-0 3/4	1-1 1/2	1-2 1/4	1-3	1-3 3/4	1-4 1/2	1-5 1/4	6
7	7 7/8	8 3/4	9 5/8	10 1/2	11 3/8	1-0 1/4	1-1 1/8	1-2	1-2 7/8	1-3 3/4	1-4 5/8	1-5 1/2	1-6 3/8	1-7 1/4	1-8 1/8	7
8	9	10	11	1-0	1-1	1-2	1-3	1-4	1-5	1-6	1-7	1-8	1-9	1-10	1-11	8
9	10 1/8	11 1/4	1-0 3/8	1-1 1/2	1-2 5/8	1-3 3/4	1-4 7/8	1-6	1-7 1/8	1-8 1/4	1-9 3/8	1-10 1/2	1-11 5/8	2-0 3/4	2-1 7/8	9
10	11 1/4	1-0 1/2	1-1 3/4	1-3	1-4 1/4	1-5 1/2	1-6 3/4	1-8	1-9 1/4	1-10 1/2	1-11 3/4	2-1	2-2 1/4	2-3 1/2	2-4 3/4	10
11	1-0 3/8	1-1 3/4	1-3 1/8	1-4 1/2	1-5 7/8	1-7 1/4	1-8 5/8	1-10	1-11 3/8	2-0 3/4	2-2 1/8	2-3 1/2	2-4 7/8	2-6 1/4	2-7 5/8	11
12	1-1 1/2	1-3	1-4 1/2	1-6	1-7 1/2	1-9	1-10 1/2	2-0	2-1 1/2	2-3	2-4 1/2	2-6	2-7 1/2	2-9	2-10 1/2	12
13	1-2 5/8	1-4 1/4	1-5 7/8	1-7 1/2	1-9 1/8	1-10 3/4	2-0 3/8	2-2	2-3 5/8	2-5 1/4	2-6 7/8	2-8 1/2	2-10 1/8	2-11 3/4	3-1 3/8	13
14	1-3 3/4	1-5 1/2	1-7 1/4	1-9	1-10 3/4	2-0 1/2	2-2 1/4	2-4	2-5 3/4	2-7 1/2	2-9 1/4	2-11	3-0 3/4	3-2 1/2	3-4 1/4	14
15	1-4 7/8	1-6 3/4	1-8 5/8	1-10 1/2	2-0 3/8	2-2 1/4	2-4 1/8	2-6	2-7 7/8	2-9 3/4	2-11 5/8	3-1 1/2	3-3 3/8	3-5 1/4	3-7 1/8	15
16	1-6	1-8	1-10	2-0	2-2	2-4	2-6	2-8	2-10	3-0	3-2	3-4	3-6	3-8	3-10	16
17	1-7 1/8	1-9 1/4	1-11 3/8	2-1 1/2	2-3 5/8	2-5 3/4	2-7 7/8	2-10	3-0 1/8	3-2 1/4	3-4 3/8	3-6 1/2	3-8 5/8	3-10 3/4	4-0 7/8	17
18	1-8 1/4	1-10 1/2	2-0 3/4	2-3	2-5 1/4	2-7 1/2	2-9 3/4	3-0	3-2 1/4	3-4 1/2	3-6 3/4	3-9	3-11 1/4	4-1 1/2	4-3 3/4	18
19	1-9 3/8	1-11 3/4	2-2 1/8	2-4 1/2	2-6 7/8	2-9 1/4	2-11 5/8	3-2	3-4 3/8	3-6 3/4	3-9 1/8	3-11 1/2	4-1 7/8	4-4 1/4	4-6 5/8	19
20	1-10 1/2	2-1	2-3 1/2	2-6	2-8 1/2	2-11	3-1 1/2	3-4	3-6 1/2	3-9	3-11 1/2	4-2	4-4 1/2	4-7	4-9 1/2	20
21	1-11 5/8	2-2 1/4	2-4 7/8	2-7 1/2	2-10 1/8	3-0 3/4	3-3 3/8	3-6	3-8 5/8	3-11 1/4	4-1 7/8	4-4 1/2	4-7 1/8	4-9 3/4	5-0 3/8	21
22	2-0 3/4	2-3 1/2	2-6 1/4	2-9	2-11 3/8	3-2 1/2	3-5 1/4	3-8	3-10 3/4	4-1 1/2	4-4 1/4	4-7	4-9 3/4	5-0 1/2	5-3 1/4	22
23	2-1 7/8	2-4 3/4	2-7 5/8	2-10 1/2	3-1 3/8	3-4 1/4	3-7 1/8	3-10	4-0 7/8	4-3 3/4	4-6 5/8	4-9 1/2	5-0 3/8	5-3 1/4	5-6 1/8	23
24	2-3	2-6	2-9	3-0	3-3	3-6	3-9	4-0	4-3	4-6	4-9	5-0	5-3	5-6	5-9	24
25	2-4 1/8	2-7 1/4	2-10 3/8	3-1 1/2	3-4 5/8	3-7 3/4	3-10 7/8	4-2	4-5 1/8	4-8 1/4	4-11 3/8	5-2 1/2	5-5 5/8	5-8 3/4	5-11 7/8	25
26	2-5 1/4	2-8 1/2	2-11 3/4	3-3	3-6 1/4	3-9 1/2	4-0 3/4	4-4	4-7 1/4	4-10 1/2	5-1 3/4	5-5	5-8 1/4	5-11 1/2	6-2 3/4	26
27	2-6 3/8	2-9 3/4	3-1 1/8	3-4 1/2	3-7 7/8	3-11 1/4	4-2 5/8	4-6	4-9 3/8	5-0 3/4	5-4 1/8	5-7 1/2	5-10 7/8	6-2 1/4	6-5 5/8	27
28	2-7 1/2	2-11	3-2 1/2	3-6	3-9 1/2	4-1	4-4 1/2	4-8	4-11 1/2	5-3	5-6 1/2	5-10	6-1 1/2	6-5	6-8 1/2	28
29	2-8 5/8	3-0 1/4	3-3 7/8	3-7 1/2	3-11 1/8	4-2 3/4	4-6 3/8	4-10	5-1 5/8	5-5 1/4	5-8 7/8	6-0 1/2	6-4 1/8	6-7 3/4	6-11 3/8	29
30	2-9 3/4	3-1 1/2	3-5 1/4	3-9	4-0 3/4	4-4 1/2	4-8 1/4	5-0	5-3 3/4	5-7 1/2	5-11 1/4	6-3	6-6 3/4	6-10 1/2	7-2 1/4	30

R9.2210a

Multiplication Table

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Multiplication Table

Pitch in Inches

No. Spcs.	3	3 1/8	3 1/4	3 3/8	3 1/2	3 3/4	4	4 1/4	4 1/2	4 3/4	5	5 1/4	5 1/2	5 3/4	6	No. Spcs.
1																1
2	6	6 1/4	6 1/2	6 3/4	7	7 1/2	8	8 1/2	9	9 1/2	10	10 1/2	11	11 1/2	1-0	2
3	9	9 3/8	9 3/4	10 1/8	10 1/2	11 1/4	1-0	1-0 3/4	1-1 1/2	1-2 1/4	1-3	1-3 3/4	1-4 1/2	1-5 1/4	1-6	3
4	1-0	1-0 1/2	1-1	1-1 1/2	1-2	1-3	1-4	1-5	1-6	1-7	1-8	1-9	1-10	1-11	2-0	4
5	1-3	1-3 5/8	1-4 1/4	1-4 7/8	1-5 1/2	1-6 3/4	1-8	1-9 1/4	1-10 1/2	1-11 3/4	2-1	2-2 1/4	2-3 1/2	2-4 3/4	2-6	5
6	1-6	1-6 3/4	1-7 1/2	1-8 1/4	1-9	1-10 1/2	2-0	2-1 1/2	2-3	2-4 1/2	2-6	2-7 1/2	2-9	2-10 1/2	3-0	6
7	1-9	1-9 7/8	1-10 3/4	1-11 5/8	2-0 1/2	2-2 1/4	2-4	2-5 3/4	2-7 1/2	2-9 1/4	2-11	3-0 3/4	3-2 1/2	3-4 1/4	3-6	7
8	2-0	2-1	2-2	2-3	2-4	2-6	2-8	2-10	3-0	3-2	3-4	3'-6	3-8	3-10	4-0	8
9	2-3	2-4 1/8	2-5 1/4	2-6 3/8	2-7 1/2	2-9 3/4	3-0	3-2 1/4	3-4 1/2	3-6 3/4	3-9	3-11 1/4	4-1 1/2	4-3 3/4	4-6	9
10	2-6	2-7 1/4	2-8 1/2	2-9 3/4	2-11	3-1 1/2	3-4	3-6 1/2	3-9	3-11 1/2	4-2	4-4 1/2	4-7	4-9 1/2	5-0	10
11	2-9	2-10 3/8	2-11 3/4	3-1 1/8	3-2 1/2	3-5 1/4	3-8	3-10 3/4	4-1 1/2	4-4 1/4	4-7	4-9 3/4	5-0 1/2	5-3 1/4	5-6	11
12	3-0	3-1 1/2	3'-3	3-4 1/2	3-6	3-9	4-0	4-3	4-6	4-9	5-0	5-3	5-6	5-9	6-0	12
13	3-3	3-4 5/8	3-6 1/4	3-7 7/8	3-9 1/2	4-0 3/4	4-4	4-7 1/4	4-10 1/2	5-1 3/4	5-5	5-8 1/4	5-11 1/2	6-2 3/4	6-6	13
14	3-6	3-7 3/4	3-9 1/2	3-11 1/4	4-1	4-4 1/2	4-8	4-11 1/2	5-3	5-6 1/2	5-10	6-1 1/2	6-5	6-8 1/2	7-0	14
15	3-9	3-10 7/8	4-0 3/4	4-2 5/8	4-4 1/2	4-8 1/4	5-0	5-3 3/4	5-7 1/2	5-11 1/4	6-3	6-6 3/4	6-10 1/2	7-2 1/4	7-6	15
16	4-0	4-2	4-4	4-6	4-8	5-0	5-4	5-8	6-0	6'-4	6-8	7-0	7-4	7-8	8-0	16
17	4-3	4-5 1/8	4-7 1/4	4-9 3/8	4-11 1/2	5-3 3/4	5-8	6-0 1/4	6-4 1/2	6-8 3/4	7-1	7-5 1/4	7-9 1/2	8-1 3/4	8-6	17
18	4-6	4-8 1/4	4-10 1/2	5-0 3/4	5-3	5-7 1/2	6-0	6-4 1/2	6-9	7-1 1/2	7-6	7-10 1/2	8-3	8-7 1/2	9-0	18
19	4-9	4-11 7/8	5-1 3/4	5-4 5/8	5-6 1/2	5-11 1/4	6-4	6-8 3/4	7-1 1/2	7-6 1/4	7-11	8-3 3/4	8-8 1/2	9-1 1/4	9-6	19
20	5-0	5-2 1/2	5-5	5-7 1/2	5-10	6-3	6-8	7-1	7-6	7-11	8-4	8-9	9-2	9-7	10-0	20
21	5-3	5-5 5/8	5-8 1/4	5-10 7/8	6-1 1/2	6-6 3/4	7-0	7-5 1/4	7-10 1/2	8-3 3/4	8-9	9-2 1/4	9-7 1/2	10-0 3/4	10-6	21
22	5-6	5-8 3/4	5-11 1/2	6-2 1/4	6-5	6-10 1/2	7-4	7-9 1/2	8-3	8-8 1/2	9-2	9-7 1/2	10-1	10-6 1/2	11-0	22
23	5-9	5-11 7/8	6-2 3/4	6-5 5/8	6-8 1/2	7-2 1/4	7-8	8-1 3/4	8-7 1/2	9-1 1/4	9-7	10-0 3/4	10-6 1/2	11-0 1/4	11-6	23
24	6-0	6-3	6-6	6-9	7-0	7-6	8-0	8-6	9-0	9-6	10-0	10-6	11-0	11-6	12-0	24
25	6-3	6-6 1/8	6-9 1/4	7-0 3/8	7-3 1/2	7-9 3/4	8-4	8-10 1/4	9-4 1/2	9-10 3/4	10-5	10-11 1/4	11-5 1/2	11-11 3/4	12-6	25
26	6-6	6-9 1/4	7-0 1/2	7-3 3/4	7-7	8-1 1/2	8-8	9-2 1/2	9-9	10-3 1/2	10-10	11-4 1/2	11-11	12-5 1/2	13-0	26
27	6-9	7-0 3/8	7-3 3/4	7-7 1/8	7-10 1/2	8-5 1/4	9-0	9-6 3/4	10-1 1/2	10-8 1/4	11-3	11-9 3/4	12-4 1/2	12-11 1/4	13-6	27
28	7-0	7-3 1/2	7-7	7-10 1/2	8-2	8-9	9-4	9-11	10-6	11-1	11-8	12-3	12-10	13-5	14-0	28
29	7-3	7-6 5/8	7-10 1/4	8-1 1/8	8-5 1/2	9-0 3/4	9-8	10-3 1/4	10-10 1/2	11-5 3/4	12-1	12-8 1/4	13-3 1/2	13-10 3/4	14-6	29
30	7-6	7-9 3/4	8-1 1/2	8-5 1/4	8-9	9-4 1/2	10-0	10-7 1/2	11-3	11-10 1/2	12-6	13-1 1/2	13-9	14-4 1/2	15-0	30

R9.2210 b

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5/8"φ SHOP RIVET VALUES

No.	SHEAR (12.000)		BEARING (24.000)					
	S.	D.	3/16	1/4	5/16	3/8	7/16	1/2
1	3.7	7.3	2.8	3.7	4.7	5.6	6.5	7.5
2	7.3	14.7	5.6	7.5	9.4	11.2	13.1	15.0
3	11.0	22.1	8.4	11.2	14.1	16.9	19.7	22.5
4	14.7	29.4	11.2	15.0	18.7	22.5	26.2	30.0
5	18.4	36.8	14.0	18.7	23.4	28.1	32.6	37.5
6	22.1	44.1	16.9	22.5	28.1	33.8	39.3	45.0
7	25.7	51.5	19.7	26.2	32.8	39.4	45.9	52.5
8	29.4	58.9	22.5	30.0	37.5	45.0	52.5	60.0
9	33.1	66.2	25.3	33.7	42.2	50.7	59.0	67.5
10	36.8	73.6	28.1	37.5	46.9	56.3	65.6	75.0
11	40.5	81.0	30.9	41.2	51.6	61.9	72.1	82.5
12	44.1	88.3	33.7	45.0	56.3	67.5	78.7	90.0
13	47.8	95.7	36.5	48.7	61.0	73.2	85.3	97.5
14	51.5	103.0	39.4	52.5	65.6	78.8	91.8	105.0
15	55.2	110.4	42.2	56.2	70.3	84.4	98.4	112.5
16	58.9	117.7	45.0	60.0	75.0	90.1	104.9	120.0
17	62.5	125.1	47.8	63.7	79.7	95.7	111.5	127.5
18	66.2	132.5	50.6	67.5	84.4	101.3	118.1	135.0
19	69.9	139.8	53.4	71.2	89.1	107.0	124.6	142.5
20	73.6	147.2	56.2	75.0	93.8	112.6	131.2	150.0

5/8"φ FIELD RIVET VALUES

No.	SHEAR (10.000)		BEARING (20.000)					
	S.	D.	3/16	1/4	5/16	3/8	7/16	1/2
1	3.1	6.1	2.3	3.1	3.9	4.7	5.4	6.2
2	6.1	12.2	4.9	6.2	7.8	9.4	10.9	12.5
3	9.2	18.3	7.0	9.4	11.7	14.1	16.4	18.8
4	12.2	24.4	9.3	12.5	15.6	18.8	21.8	25.0
5	15.3	30.5	11.7	15.6	19.5	23.5	27.3	31.2
6	18.4	36.6	12.6	18.8	23.4	28.2	32.8	37.6
7	21.4	42.6	16.4	21.8	27.2	32.8	38.2	43.6
8	24.4	48.8	18.7	25.0	31.2	37.6	43.6	50.0
9	27.6	54.8	21.1	28.0	35.0	42.2	49.2	56.0
10	30.6	61.0	23.4	31.2	39.0	47.0	54.6	62.4
11	33.6	67.0	25.7	34.4	42.8	51.6	60.0	68.8
12	36.8	73.2	28.1	37.4	46.8	56.4	65.6	74.8
13	39.8	79.2	30.4	40.6	50.6	61.0	71.0	81.2
14	42.8	85.4	32.7	43.6	54.6	65.8	76.4	87.2
15	45.8	91.4	35.1	46.8	58.4	70.4	81.8	93.6
16	49.0	97.6	37.5	50.0	62.4	75.2	87.4	100.0
17	52.0	103.6	39.8	53.0	66.2	79.8	92.8	106.0
18	55.0	109.8	42.1	56.2	70.2	84.6	98.2	112.4
19	58.2	115.8	44.5	59.2	74.0	89.2	103.8	118.4
20	61.2	122.0	46.8	62.4	78.0	94.0	109.2	124.8

All Values in Thousands of Lbs.

5/8"φ BOLT VALUES

No.	SHEAR (9.000)		BEARING (18.000)					
	S.	D.	3/16	1/4	5/16	3/8	7/16	1/2
1	2.7	5.5	2.1	2.8	3.5	4.2	4.9	5.6
2	5.5	11.0	4.2	5.6	7.0	8.4	9.8	11.2
3	8.2	16.5	6.3	8.4	10.5	12.6	14.7	16.8
4	11.0	22.0	8.4	11.2	14.0	16.8	19.6	22.5
5	13.8	27.6	10.5	14.0	17.5	21.0	24.6	28.1

No.	SHEAR (9.000)		BEARING (18.000)					
	S.	D.	3/16	1/4	5/16	3/8	7/16	1/2
6	16.5	33.1	12.6	16.8	21.0	25.3	29.5	33.6
7	19.3	38.6	14.7	19.6	24.6	29.5	34.4	39.2
8	22.0	44.1	16.8	22.5	28.1	33.7	39.3	45.0
9	24.8	49.6	18.9	25.3	31.6	37.9	44.2	50.6
10	27.6	55.2	21.0	28.1	35.1	42.1	49.2	56.2

R9.2211a

Multiple Rivet Values 5/8"φ Am. Bdge Co's Specfs.

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3/4" ϕ SHOP RIVET VALUES

No.	SHEAR (12.000)		BEARING (24.000)					
	S.	D.	1/4	5/16	3/8	7/16	1/2	9/16
1	5.3	10.6	4.5	5.6	6.7	7.9	9.0	10.1
2	10.6	21.2	9.0	11.2	13.5	15.7	18.0	20.2
3	15.9	31.8	13.5	16.9	20.2	23.6	27.0	30.4
4	21.2	42.4	18.0	22.5	27.0	31.5	36.0	40.5
5	26.5	53.0	22.5	28.1	33.8	39.4	45.0	50.6
6	31.8	63.6	27.0	33.8	40.5	47.3	54.0	60.8
7	37.1	74.2	31.5	39.4	47.2	55.1	63.0	70.9
8	42.4	84.8	36.0	45.0	54.0	63.0	72.0	81.0
9	47.7	95.4	40.5	50.7	60.7	70.9	81.0	91.2
10	53.0	106.0	45.0	56.3	67.5	78.8	90.0	101.3
11	58.3	116.6	49.5	61.9	74.2	86.7	99.0	111.4
12	63.6	127.2	54.0	67.5	81.0	94.5	108.0	121.5
13	68.9	137.8	58.5	73.2	87.7	102.4	117.0	131.7
14	74.2	148.4	63.0	78.8	94.5	110.3	126.0	141.8
15	79.5	159.0	67.5	84.4	101.2	118.2	135.0	151.9
16	84.8	169.6	72.0	90.1	108.0	126.1	144.0	162.1
17	90.1	180.2	76.5	95.7	114.7	133.9	153.0	172.2
18	95.4	190.8	81.0	101.3	121.5	141.8	162.0	182.3
19	100.7	201.4	85.5	106.9	128.2	149.7	171.0	192.5
20	106.0	212.0	90.0	112.6	135.0	157.6	180.0	202.6

3/4" ϕ FIELD RIVET VALUES

No.	SHEAR (10.000)		BEARING (20.000)					
	S.	D.	1/4	5/16	3/8	7/16	1/2	9/16
1	4.4	8.8	3.7	4.7	5.6	6.6	7.5	8.4
2	8.8	17.6	7.5	9.4	11.2	13.1	15.0	16.8
3	13.2	26.4	11.2	14.1	16.9	19.7	22.5	25.6
4	17.6	35.2	14.9	18.8	22.4	26.2	30.0	33.6
5	22.0	44.0	18.7	23.5	28.1	32.8	37.5	42.1
6	26.4	52.8	22.4	28.2	33.8	39.4	45.0	50.6
7	30.8	61.6	26.2	32.8	39.4	46.0	52.6	59.0
8	35.2	70.4	30.0	37.6	45.0	52.4	60.0	67.4
9	39.6	79.2	33.6	42.2	50.6	59.0	67.6	75.8
10	44.0	88.0	37.4	47.0	56.2	65.6	75.0	84.2
11	48.4	96.8	41.2	51.6	61.8	72.2	82.6	92.6
12	52.8	105.6	44.8	56.4	67.4	78.8	90.0	101.0
13	57.2	114.4	48.6	61.0	73.0	85.2	97.6	109.4
14	61.6	123.2	52.4	65.8	78.6	91.8	105.0	117.8
15	66.0	132.0	56.0	70.4	84.4	98.4	112.6	126.4
16	70.4	140.8	59.8	75.2	90.0	105.0	120.0	134.8
17	74.8	149.6	63.6	79.8	95.6	111.6	127.4	143.2
18	79.2	158.4	67.4	84.6	101.2	118.0	135.0	151.6
19	83.6	167.2	71.0	89.2	106.8	124.6	142.6	160.0
20	88.0	176.0	74.8	94.0	112.4	131.2	150.0	168.4

All Values in Thousands of Lb

3/4" ϕ BOLT VALUES

No.	SHEAR (9.000)		BEARING (18.000)					
	S.	D.	1/4	5/16	3/8	7/16	1/2	9/16
1	3.9	7.9	3.3	4.2	5.0	5.9	6.7	7.5
2	7.9	15.9	6.7	8.4	10.1	11.8	13.5	15.1
3	11.9	23.8	10.1	12.6	15.1	17.7	20.2	22.7
4	15.9	31.8	13.5	16.8	20.2	23.6	27.0	30.3
5	19.8	39.7	16.8	21.0	25.3	29.5	33.7	37.9

No.	SHEAR (9.000)		BEARING (18.000)					
	S.	D.	1/4	5/16	3/8	7/16	1/2	9/16
6	23.8	47.7	20.2	25.3	30.3	35.4	40.5	45.5
7	27.8	55.6	23.6	29.5	35.4	41.3	47.2	53.1
8	31.8	63.6	27.0	33.8	40.5	47.2	54.0	60.7
9	35.7	71.5	30.3	37.9	45.5	53.1	60.7	68.3
10	39.7	79.5	33.7	42.1	50.6	59.0	67.2	75.9

Multiple Rivet Values 3/4" ϕ Am. Bdge Co's Specfs.

R 9.22114

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7/8" ϕ SHOP RIVET VALUES

No.	SHEAR (12.000)		BEARING (24.000)						
	S.	D.	5/16	3/8	7/16	1/2	9/16	5/8	11/16
1	7.2	14.4	6.5	7.9	9.2	10.5	11.8	13.1	14.4
2	14.4	28.9	13.1	15.7	18.4	21.0	23.6	26.2	28.9
3	21.6	43.3	19.7	23.6	27.6	31.5	35.4	39.4	43.3
4	28.9	57.7	26.2	31.5	36.7	42.0	47.2	52.5	57.7
5	36.1	72.2	32.8	39.4	45.9	52.5	59.0	65.6	72.2
6	43.3	86.6	39.3	47.3	55.1	63.0	70.8	78.8	86.6
7	50.5	101.1	45.9	55.1	64.3	73.5	82.7	91.9	101.1
8	57.7	115.5	52.5	63.0	73.5	84.0	94.5	105.0	115.5
9	65.0	129.9	59.0	70.9	82.7	94.5	106.3	118.2	129.9
10	72.2	144.4	65.6	78.8	91.9	105.0	118.1	131.3	144.4
11	79.4	158.8	72.1	86.7	101.1	115.5	129.9	144.4	158.8
12	86.6	173.3	78.7	94.5	110.3	126.0	141.7	157.5	173.3
13	93.8	187.7	85.3	102.4	119.5	136.5	153.5	170.7	187.7
14	101.1	202.1	91.8	110.3	128.6	147.0	165.3	183.8	202.1
15	108.3	216.6	98.4	118.2	137.8	157.5	177.1	196.9	216.6
16	115.5	231.0	104.9	126.1	147.0	168.0	188.9	210.1	231.0
17	122.7	245.5	111.5	133.9	156.2	178.5	200.8	223.2	245.4
18	129.9	259.9	118.1	141.8	165.4	189.0	212.6	236.3	259.9
19	137.2	274.3	124.6	149.7	174.6	199.5	224.4	249.5	274.3
20	144.4	288.8	131.2	157.6	183.8	210.0	236.2	262.6	288.8

7/8" ϕ FIELD RIVET VALUES

No.	SHEAR (10.000)		BEARING (20.000)						
	S.	D.	5/16	3/8	7/16	1/2	9/16	5/8	11/16
1	6.0	12.0	5.5	6.6	7.7	8.7	9.8	10.9	12.0
2	12.0	24.0	10.9	13.1	15.3	17.4	19.6	21.8	24.1
3	18.0	36.0	16.3	19.6	22.9	26.2	29.5	32.8	36.1
4	24.0	48.0	21.8	26.2	30.6	34.9	39.2	43.7	48.1
5	30.0	60.0	27.3	32.8	38.3	43.7	49.2	54.7	60.2
6	36.0	72.0	32.8	39.4	46.0	52.4	59.0	65.6	72.2
7	42.0	84.0	38.2	46.0	53.6	61.2	68.8	76.6	84.2
8	48.0	96.0	43.6	52.4	61.2	70.0	78.8	87.6	96.2
9	54.0	108.0	49.2	59.0	69.0	78.6	88.6	98.4	108.3
10	60.0	120.0	54.6	65.6	77.0	87.4	98.4	109.4	120.3
11	66.0	132.0	60.0	72.2	84.2	96.2	108.2	120.4	132.3
12	72.0	144.0	65.6	78.8	92.0	104.8	118.0	131.2	144.4
13	78.0	156.0	71.0	85.2	99.6	113.6	128.0	142.2	156.4
14	84.0	168.0	76.4	91.8	107.2	122.4	137.8	153.2	168.4
15	90.0	180.0	81.8	98.4	115.0	131.2	147.6	164.2	180.5
16	96.0	192.0	87.4	105.0	122.6	139.8	157.4	175.0	192.5
17	102.0	204.0	92.8	111.6	130.2	148.6	167.2	186.0	204.5
18	108.0	216.0	98.2	118.0	137.8	157.4	177.2	197.0	216.6
19	114.0	228.0	103.8	124.6	145.6	166.0	187.0	207.8	228.6
20	120.0	240.0	109.2	131.2	153.2	174.8	196.8	218.8	240.6

All Values in Thousands of Lbs.

7/8" ϕ BOLT VALUES

No.	SHEAR (9.000)		BEARING (18.000)						
	S.	D.	5/16	3/8	7/16	1/2	9/16	5/8	11/16
1	5.4	10.8	4.9	5.9	6.8	7.8	8.8	9.8	10.8
2	10.8	21.6	9.8	11.8	13.7	15.7	17.7	19.6	21.7
3	16.2	32.4	14.7	17.7	20.6	23.6	26.5	29.5	32.5
4	21.6	43.2	19.6	23.6	27.5	31.5	35.4	39.3	43.3
5	27.0	54.1	24.6	29.5	34.4	39.3	44.2	49.2	54.1

No.	SHEAR (9.000)		BEARING (18.000)						
	S.	D.	5/16	3/8	7/16	1/2	9/16	5/8	11/16
6	32.4	64.9	29.5	35.4	41.3	47.2	53.1	59.0	64.9
7	37.8	75.7	34.4	41.3	48.2	55.1	62.0	68.9	75.8
8	43.2	86.5	39.3	47.2	55.1	63.0	70.8	78.7	86.6
9	48.7	97.3	44.2	53.1	62.0	70.8	79.7	88.5	97.5
10	54.1	108.2	49.2	59.0	68.9	78.7	88.5	98.4	108.3

R9.2211C

Multiple Rivet Values 7/8" ϕ Am. Bdge Co's Specfs.

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5/8" ϕ SHOP RIVET VALUES

No.	SHEAR (10000)		BEARING (20000)				
	S.	D.	1/4	5/16	3/8	7/16	1/2
1	3.1	6.1	3.1	3.9	4.7	5.4	6.2
2	6.1	12.2	6.2	7.8	9.4	10.9	12.4
3	9.2	18.3	9.4	11.7	14.1	16.4	18.7
4	12.2	24.4	12.5	15.6	18.8	21.8	24.8
5	15.3	30.5	15.6	19.5	23.5	27.3	31.0
6	18.4	36.6	18.8	23.4	28.2	32.8	37.2
7	21.4	42.6	21.8	27.2	32.8	38.2	43.4
8	24.4	48.8	25.0	31.2	37.6	43.6	49.6
9	27.6	54.8	28.0	35.0	42.2	49.2	55.8
10	30.6	61.0	31.2	39.0	47.0	54.6	62.0
11	33.6	67.0	34.4	42.8	51.6	60.0	68.2
12	36.8	73.2	37.4	46.8	56.4	65.6	74.4
13	39.8	79.2	40.6	50.6	61.0	71.0	80.6
14	42.8	85.4	43.6	54.6	65.8	76.4	86.8
15	45.8	91.4	46.8	58.4	70.4	81.8	93.0
16	49.0	97.6	50.0	62.4	75.2	87.4	99.2
17	52.0	103.6	53.0	66.2	79.8	92.8	105.4
18	55.0	109.8	56.2	70.2	84.6	98.2	111.6
19	58.2	115.8	59.2	74.0	89.2	103.8	117.8
20	61.2	122.0	62.4	78.0	94.0	109.2	124.0

5/8" ϕ FIELD RIVET VALUES

No.	SHEAR (8000)		BEARING (16000)				
	S.	D.	1/4	5/16	3/8	7/16	1/2
1	2.4	4.9	2.5	3.1	3.8	4.4	5.0
2	4.9	9.7	5.0	6.2	7.5	8.7	10.0
3	7.3	14.6	7.5	9.4	11.3	13.1	15.0
4	9.8	19.5	10.0	12.5	15.0	17.4	20.0
5	12.2	24.4	12.5	15.6	18.8	21.8	25.0
6	14.6	29.3	15.0	18.7	22.6	26.2	30.0
7	17.1	34.2	17.5	21.8	26.3	30.5	35.0
8	19.5	39.0	20.0	25.0	30.1	34.9	40.0
9	22.0	43.9	22.5	28.1	33.8	39.2	45.0
10	24.4	48.8	25.0	31.2	37.6	43.6	50.0
11	26.8	53.7	27.5	34.3	41.4	48.0	55.0
12	29.3	58.6	30.0	37.4	45.1	52.3	60.0
13	31.7	63.4	32.5	40.6	48.9	56.7	65.0
14	34.2	68.3	35.0	43.7	52.6	61.0	70.0
15	36.6	73.2	37.5	46.8	56.4	65.4	75.0
16	39.0	78.1	40.0	49.9	60.2	69.8	80.0
17	41.5	83.0	42.5	53.0	63.9	74.1	85.0
18	43.9	87.8	45.0	56.2	67.7	78.5	90.0
19	46.4	92.7	47.5	59.3	71.4	83.8	95.0
20	48.8	97.6	50.0	62.4	75.2	87.2	100.0

All Values in Thousands of Lbs.

3/8" ϕ BOLT VALUES

No.	SHEAR (7000)		BEARING (14000)				
	S.	D.	1/4	5/16	3/8	7/16	1/2
1	2.1	4.3	2.2	2.7	3.3	3.8	4.4
2	4.3	8.6	4.4	5.4	6.6	7.6	8.8
3	6.4	12.8	6.5	8.2	9.8	11.5	13.1
4	8.6	17.1	8.7	10.9	13.1	15.3	17.5
5	10.7	21.4	10.9	13.6	16.4	19.1	21.9

No.	SHEAR (7000)		BEARING (14000)				
	S.	D.	1/4	5/16	3/8	7/16	1/2
6	12.8	25.6	13.0	16.4	19.6	23.0	26.3
7	15.0	30.0	15.2	19.0	23.0	26.8	30.7
8	17.2	34.2	17.4	21.8	26.2	30.6	35.0
9	19.2	38.6	19.6	24.4	29.6	34.4	39.4
10	21.4	42.8	21.8	27.2	32.8	38.2	43.8

R9221294

Multiple Rivet Values 5/8" ϕ N.Y.C. Bldg Law

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3/4"ϕ SHOP RIVET VALUES

No.	SHEAR (10,000)		BEARING (20,000)					
	S.	D.	1/4	5/16	3/8	7/16	1/2	9/16
1	4.4	8.8	3.7	4.7	5.6	6.6	7.5	8.4
2	8.8	17.6	7.5	9.4	11.2	13.1	15.0	16.8
3	13.2	26.4	11.2	14.1	16.9	19.7	22.5	25.6
4	17.6	35.2	14.9	18.8	22.4	26.2	30.0	33.6
5	22.0	44.0	18.7	23.5	28.1	32.8	37.5	42.1
6	26.4	52.8	22.4	28.2	33.8	39.4	45.0	50.6
7	30.8	61.6	26.2	32.8	39.4	46.0	52.6	59.0
8	35.2	70.4	30.0	37.6	45.0	52.4	60.0	67.4
9	39.6	79.2	33.6	42.2	50.6	59.0	67.6	75.8
10	44.0	88.0	37.4	47.0	56.2	65.6	75.0	84.2
11	48.4	96.8	41.2	51.6	61.8	72.2	82.6	92.6
12	52.8	105.6	44.8	56.4	67.4	78.8	90.0	101.0
13	57.2	114.4	48.6	61.0	73.0	85.2	97.6	109.4
14	61.6	123.2	52.4	65.8	78.6	91.8	105.0	117.8
15	66.0	132.0	56.0	70.4	84.4	98.4	112.6	126.4
16	70.4	140.8	59.8	75.2	90.0	105.0	120.0	134.8
17	74.8	149.6	63.6	79.8	95.6	111.6	127.6	143.2
18	79.2	158.4	67.4	84.6	101.2	118.0	135.0	151.6
19	83.6	167.2	71.0	89.2	106.8	124.6	142.6	160.0
20	88.0	176.0	74.8	94.0	112.4	131.2	150.0	168.4

3/4"ϕ FIELD RIVET VALUES

No.	SHEAR (8,000)		BEARING (16,000)					
	S.	D.	1/4	5/16	3/8	7/16	1/2	9/16
1	3.5	7.0	3.0	3.8	4.5	5.2	6.0	6.7
2	7.0	14.1	6.0	7.5	9.0	10.5	12.0	13.5
3	10.6	21.1	9.0	11.3	13.5	15.7	18.0	20.2
4	14.1	28.2	12.0	15.0	18.0	21.0	24.0	27.0
5	17.6	35.2	15.0	18.8	22.5	26.2	30.0	33.7
6	21.1	42.2	18.0	22.6	27.0	31.4	36.0	40.4
7	24.6	49.3	21.0	26.3	31.5	36.7	42.0	47.2
8	28.2	56.3	24.0	30.1	36.0	41.9	48.0	53.9
9	31.7	63.4	27.0	33.8	40.5	47.2	54.0	60.7
10	35.2	70.4	30.0	37.6	45.0	52.4	60.0	67.4
11	38.7	77.4	33.0	41.4	49.5	57.6	66.0	74.1
12	42.2	84.5	36.0	45.1	54.0	62.9	72.0	80.9
13	45.8	91.5	39.0	48.9	58.5	68.1	78.0	87.6
14	49.3	98.6	42.0	52.6	63.0	73.4	84.0	94.4
15	52.8	105.6	45.0	56.4	67.5	78.6	90.0	101.1
16	56.3	112.6	48.0	60.2	72.0	83.8	96.0	107.8
17	59.8	119.7	51.0	63.9	76.5	89.1	102.0	114.6
18	63.4	126.7	54.0	67.7	81.0	94.3	108.0	121.3
19	66.9	133.8	57.0	71.4	85.5	99.6	114.0	128.1
20	70.4	140.8	60.0	75.2	90.0	104.8	120.0	134.8

All Values in Thousands of Lbs.

3/4"ϕ BOLT VALUES

No.	SHEAR (7,000)		BEARING (14,000)					
	S.	D.	1/4	5/16	3/8	7/16	1/2	9/16
1	3.1	6.2	2.6	3.3	3.9	4.6	5.2	5.9
2	6.2	12.4	5.2	6.6	7.8	9.2	10.4	11.8
3	9.2	18.5	7.9	9.8	11.8	13.7	15.7	17.7
4	12.4	24.7	10.5	13.1	15.6	18.3	20.9	23.6
5	15.4	30.9	13.1	16.4	19.6	22.9	26.2	29.5

No.	SHEAR (7,000)		BEARING (14,000)					
	S.	D.	1/4	5/16	3/8	7/16	1/2	9/16
6	18.4	37.0	15.8	19.6	23.6	27.4	31.4	35.4
7	21.6	43.2	18.4	23.0	27.4	32.0	36.6	41.4
8	24.6	49.4	21.0	26.2	31.4	36.6	42.0	47.2
9	27.8	55.6	23.6	29.6	35.2	41.2	47.2	53.2
10	30.8	61.8	26.2	32.8	39.2	45.8	52.4	59.0

R9.22129

Multiple Rivet Values 3/4"ϕ N.Y.C. Bldg Law

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7/8" ϕ SHOP RIVET VALUES

No.	SHEAR (10.000)		BEARING (20.000)						
	S.	D.	5/16	3/8	7/16	1/2	9/16	5/8	11/16
1	6.0	12.0	5.5	6.6	7.7	8.7	9.8	10.9	12.0
2	12.0	24.0	10.9	13.1	15.3	17.4	19.6	21.8	24.1
3	18.0	36.0	16.3	19.6	22.9	26.2	29.5	32.8	36.0
4	24.0	48.0	21.8	26.2	30.6	34.9	39.2	43.7	48.1
5	30.0	60.0	27.3	32.8	38.3	43.7	49.2	54.7	60.2
6	36.0	72.0	32.8	39.4	46.0	52.4	59.0	65.6	72.2
7	42.0	84.0	38.2	46.0	53.6	61.2	68.8	76.6	84.2
8	48.0	96.0	43.6	52.4	61.2	70.0	78.8	87.6	96.2
9	54.0	108.0	49.2	59.0	69.0	78.6	88.6	98.4	108.2
10	60.0	120.0	54.6	65.6	77.0	87.4	98.4	109.4	120.2
11	66.0	132.0	60.0	72.2	84.2	96.2	108.2	120.4	132.2
12	72.0	144.0	65.6	78.8	92.0	104.8	118.0	131.2	144.4
13	78.0	156.0	71.0	85.2	99.6	113.6	128.0	142.2	156.4
14	84.0	168.0	76.4	91.8	107.2	122.4	137.8	153.2	168.4
15	90.0	180.0	81.8	98.4	115.0	131.2	147.6	164.2	180.4
16	96.0	192.0	87.4	105.0	122.6	139.8	157.4	175.0	192.4
17	102.0	204.0	92.8	111.6	130.2	148.6	167.2	186.0	204.4
18	108.0	216.0	98.2	118.0	137.8	157.4	177.2	197.0	216.4
19	114.0	228.0	103.6	124.6	145.6	166.0	186.8	207.8	228.4
20	120.0	240.0	109.2	131.2	153.2	174.8	196.8	218.8	240.4

7/8" ϕ FIELD RIVET VALUES

No.	SHEAR (8.000)		BEARING (16.000)						
	S.	D.	5/16	3/8	7/16	1/2	9/16	5/8	11/16
1	4.8	9.6	4.4	5.2	6.1	7.0	7.9	8.8	9.6
2	9.6	19.2	8.8	10.4	12.2	14.0	15.8	17.6	19.2
3	14.4	28.8	13.2	15.6	18.3	21.0	23.7	26.4	28.8
4	19.2	38.4	17.6	20.8	24.4	28.0	31.6	35.2	38.4
5	24.0	48.0	22.0	26.0	30.5	35.0	39.5	44.0	48.0
6	28.8	57.6	26.4	31.2	36.6	42.0	47.4	52.8	57.6
7	33.6	67.2	30.8	36.4	42.7	49.0	55.3	61.6	67.2
8	38.4	76.8	35.2	41.6	48.8	56.0	63.2	70.4	76.8
9	43.2	86.4	39.6	46.8	54.9	63.0	71.1	79.2	86.4
10	48.0	96.0	44.0	52.0	61.0	70.0	79.0	88.0	96.0
11	52.8	105.6	48.4	57.2	67.1	77.0	86.9	96.8	105.6
12	57.6	115.2	52.8	62.4	73.2	84.0	94.8	105.6	115.2
13	62.4	124.8	57.2	67.6	79.3	91.0	102.7	114.4	124.8
14	67.2	134.4	61.6	72.8	85.4	98.0	110.6	123.2	134.4
15	72.0	144.0	66.0	78.0	91.5	105.0	118.5	132.0	144.0
16	76.8	153.6	70.4	83.2	97.6	112.0	126.4	140.8	153.6
17	81.6	163.2	74.8	88.4	103.7	119.0	134.3	149.6	163.2
18	86.4	172.8	79.2	93.6	109.8	126.0	142.2	158.4	172.8
19	91.2	182.4	83.6	98.8	115.9	133.0	150.1	167.2	182.4
20	96.0	192.0	88.0	104.0	122.0	140.0	158.0	176.0	192.0

All Values in Thousands of Lbs

7/8" ϕ BOLT VALUES

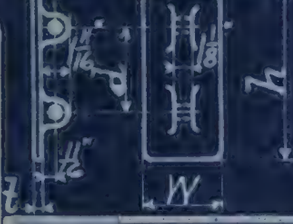
No.	SHEAR (7.000)		BEARING (14.000)						
	S.	D.	5/16	3/8	7/16	1/2	9/16	5/8	11/16
1	4.2	8.4	3.8	4.6	5.3	6.1	6.9	7.6	8.4
2	8.4	16.8	7.6	9.1	10.6	12.2	13.7	15.2	16.8
3	12.6	25.2	11.4	13.7	16.0	18.3	20.6	22.9	25.2
4	16.8	33.6	15.2	18.3	21.3	24.4	27.4	30.5	33.6
5	21.0	42.0	19.1	22.9	26.7	30.6	34.4	38.2	42.0
6	25.2	50.4	23.0	27.4	32.0	36.8	41.2	45.8	50.4
7	29.4	58.8	26.8	32.0	37.4	42.8	48.2	53.4	58.8
8	33.6	67.2	30.6	36.6	42.8	49.0	55.0	61.2	67.2
9	37.8	75.6	34.4	41.2	48.0	55.0	62.0	68.8	75.6
10	42.0	84.0	38.2	45.8	53.4	61.2	68.8	76.4	84.0

Multiple Rivet Values 7/8" ϕ N.Y.C. Bld'g Law

R9.2212C

S5.161 a

CAST IRON SEPARATORS



7/8" ϕ Cored Holes
For 5", 4", + 3" Beams use
1" ϕ Gas Pipe - 3 1/4", 3" + 2 3/4"
long respectively.

BEAMS				SEPARATORS						BOLTS		
Size Inches	Weight per Foot Lbs	Distance C. to C.	Out to Out Flanges	W	h	d	t	Weight Each Lbs	Increase in wt. for 1" add'l Width	Length	Weight incl Nuts Lbs	Increase in wt. for 1" add'l Width
24	115	8 3/4	16 3/4	8	20	12	5/8	31	3.6	10 1/2	3.6	.25
	100	8	15 1/2	7 1/4	"	"	"	28	"	10	3.5	
	95 + 90	"	15 1/4	"	"	"	"	"	"	"	"	
	85	"	"	7 1/2	"	"	"	29	"	9 1/2	3.3	
	80	"	15	"	"	"	"	"	"	"	"	
20	100 + 95	8	15 1/4	7	16	12	5/8	22	2.9	10	3.5	.25
	90	7 1/2	14 3/4	6 3/4	"	"	"	"	"	9 1/2	3.3	
	85 + 80	"	14 1/2	"	"	"	"	"	"	9	3.2	
	75	"	14	"	"	"	"	"	"	"	"	
	70	7	13 1/2	6 1/2	"	"	"	21	"	"	"	
	65	"	13 1/4	"	"	"	"	"	"	8 1/2	"	
18	90	8	15 1/4	7	14	9	5/8	20	2.5	10	3.5	.25
	85	"	15 1/8	7 1/4	"	"	"	21	"	"	"	"
	80	"	"	"	"	"	"	"	"	"	"	"
	75	"	15	7 1/2	"	"	"	"	"	"	"	"
	70 + 65	7	13 1/4	6 1/4	"	"	"	18	"	9	3.2	"
	60	"	"	6 1/2	"	"	"	19	"	8 1/2	"	"
	55	"	13	"	"	"	"	"	"	"	"	"
15	100 + 95	7 1/2	14 1/4	6 1/4	11	7 1/2	1/2	12	1.6	9 1/2	3.3	.25
	90	"	"	6 1/2	"	"	"	"	"	"	"	"
	85	"	14	"	"	"	"	"	"	"	"	"
	80 + 75	7	13 1/4	6	"	"	"	"	"	9	3.2	"
	70 + 65	"	"	6 1/4	"	"	"	"	"	"	"	"
	60	6 1/2	12 1/2	5 3/4	"	"	"	11	"	8	3.0	"
	55	"	12 1/4	"	"	"	"	"	"	"	"	
	50 + 45	"	"	6	"	"	"	12	"	"	"	
	42	"	12	"	"	"	"	"	"	"	"	
12	55	6	11 3/4	5 1/4	8 3/4	5	1/2	9	1.3	8	3.0	.25
	50	"	11 1/2	"	"	"	"	"	"	"	"	"
	45	"	11 1/4	"	"	"	"	"	"	7 1/2	2.9	"
	40 + 35	"	"	5 1/2	"	"	"	"	"	"	"	"
	31.5	"	11	"	"	"	"	"	"	"	"	"
10	40	5 1/2	10 3/4	4 3/4	7 1/2		1/2	6	1.1	7 1/2	1.4	.13
	35	"	10 1/2	"	"		"	"	"	7	"	"
	30	"	"	5	"		"	7	"	"	"	"
	25	"	10	"	"		"	"	"	"	"	"
9	35	5	10	4 1/4	6 1/2		1/2	5	0.9	7	1.4	.13
	30	"	9 1/2	"	"		"	"	"	6 1/2	1.3	"
	25	"	"	4 1/2	"		"	"	"	"	"	"
	21	"	9 1/4	"	"		"	"	"	"	"	"
8	25.5	4 1/2	9	4	5 1/2		1/2	4	0.8	6	1.2	.13
	23	"	8 3/4	"	"		"	"	"	"	"	"
	20.5 + 18	"	8 1/2	"	"		"	"	"	"	"	"
7	20	4 1/2	8 1/2	4	5		1/2	4	0.7	6	1.2	.13
	17.5	"	8 1/4	"	"		"	"	"	"	"	"
	15	"	"	4 1/4	"		"	"	"	"	"	"
6	17.25	4	7 3/4	3 1/2	4 1/2		1/2	4	0.6	5 1/2	1.2	.13
	14.75	"	7 1/2	"	"		"	"	"	"	"	"
	12.25	"	"	3 3/4	"		"	"	"	"	"	"

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SKEW - BACKS

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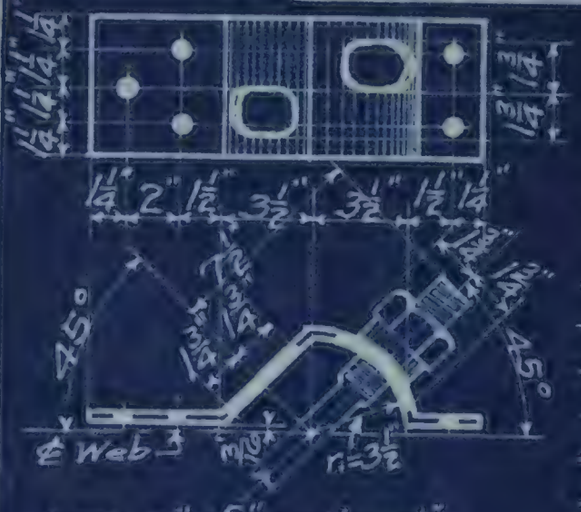
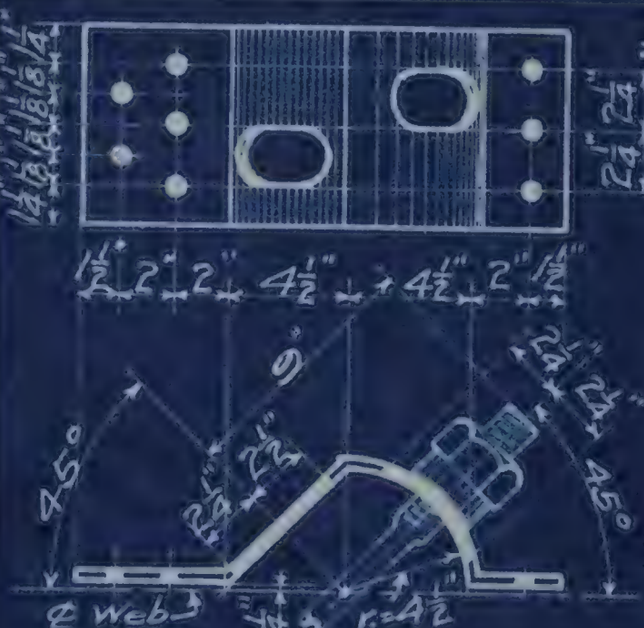


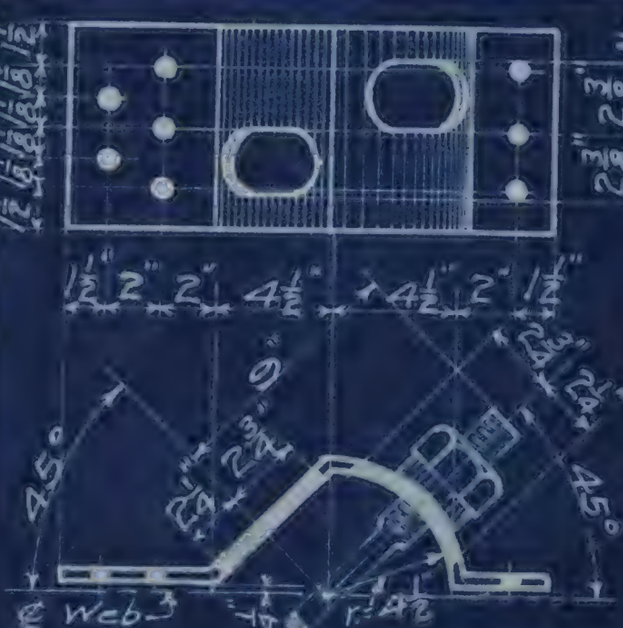
SKEW-BACK "A" - Wt. 6.8#

Skew-back "A" for rods up to 1¼"ϕ or 1⅛" □ (upset to 1⅝"ϕ)
For upsets 1⅛"ϕ or less, ∠ of rod may vary from 32°(7½" in 12") to 60°(12" in 6 15/16"). For upsets greater than 1⅛"ϕ upto 1⅝"ϕ, ∠ of rod may vary from 41½°(10⅝" in 12") to 60°(12" in 6 15/16").
Std. Slot in beam = 3½" × 6".
Use Std. Skew-back Wash. Patt. Nos. A81, 82, 83 - See Sht. W1.191a.



SKEW-BACK "B" - Wt. 17.#

Skew-back "B" for rods 1¼"ϕ or 1⅛"□ (upset to 1⅝"ϕ) up to 1½"ϕ (upset to 1⅞"ϕ) or 1⅜"□ (upset to 2"ϕ)
For upsets 1⅝"ϕ or less, ∠ of rod may vary from 33⅔°(8" in 12") to 60°(12" in 6 15/16"). For upsets greater than 1⅝"ϕ up to 2"ϕ, ∠ of rod may vary from 38⅔°(9 19/32" in 12") to 60°(12" in 6 15/16").
Std Slot in beam - 4¼" × 6½"
Use std. Skew-back Wash. Patt. Nos. A84, 85, 86 - See Sht. W1.191a.

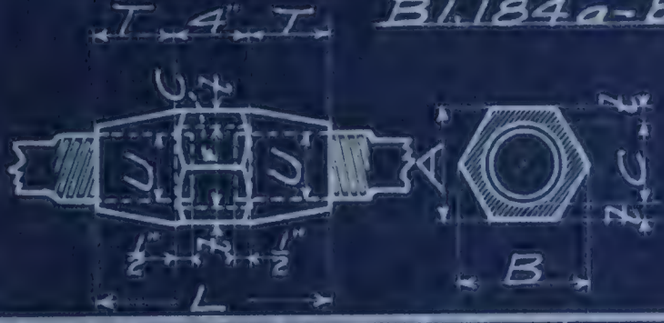


SKEW-BACK "C" Wt. 23#

Skew-back "C" for rods 1 9/16"ϕ or 1 7/16" □ (upset to 2"ϕ) up to 1¾"ϕ (upset to 2⅛"ϕ) or 1½" □ (upset to 2¼"ϕ).
Angle of rod may vary from 40½°(10¼" in 12") to 64⅓°(12" in 5¾") for all rods.
Std. Slot in beam 4¾" × 6½"
Use Std. Skew-back Wash. Patt No. A86 - See Sht. W1.191a.
Where upset end of rod is greater than 2⅛"ϕ, hole in washer to be drilled to fit upset.

SLEEVE-NUTS

For upsets see sheets – B1.184a-b



Sleeve-Nuts for U= 2" & over are manufactured by A.B.Co.

Dia. of Screw U	Length of Thread T	Length of Nut L	Short Diam. A	Long Diam B	Inside Diam C	Thickness T	Weight in lbs
7/8	1 1/2	7	1 5/8	1 7/8	1 1/8	1/4	3
1	"	"	"	"	"	"	3
1 1/8	1 3/4	7 1/2	2	2 5/16	1 3/8	5/16	4
1 1/4	"	"	"	"	"	"	4
1 3/8	2	8	2 3/8	2 3/4	1 5/8	3/8	5
1 1/2	"	"	"	"	"	"	6
1 5/8	2 1/4	8 1/2	2 3/4	3 3/16	1 7/8	7/16	8
1 3/4	"	"	"	"	"	"	9
1 7/8	2 1/2	9	3 1/8	3 5/8	2 1/8	1/2	10
2	"	"	"	"	"	"	11
2 1/8	2 3/4	9 1/2	3 1/2	4 1/16	2 3/8	9/16	14
2 1/4	"	"	"	"	"	"	15
2 3/8	3	10	3 7/8	4 1/2	2 5/8	5/8	18
2 1/2	"	"	"	"	"	"	19
2 3/4	3 1/4	10 1/2	4 1/4	4 15/16	2 7/8	11/16	23
2 7/8	3 1/2	11	4 5/8	5 3/8	3 1/8	3/4	27
3	"	"	"	"	"	"	28
3 1/4	3 3/4	11 1/2	5	5 13/16	3 3/8	13/16	35
3 1/2	4	12	5 3/8	6 1/4	3 5/8	7/8	40
3 3/4	4 1/4	12 1/2	5 3/4	6 11/16	3 7/8	15/16	47
4	4 1/2	13	6 1/8	7 1/16	4 1/8	1	55
4 1/4	4 3/4	13 1/2	6 1/2	7 1/2	4 3/8	1 1/16	65
4 1/2	5	14	6 7/8	7 15/16	4 3/4	1 1/16	75

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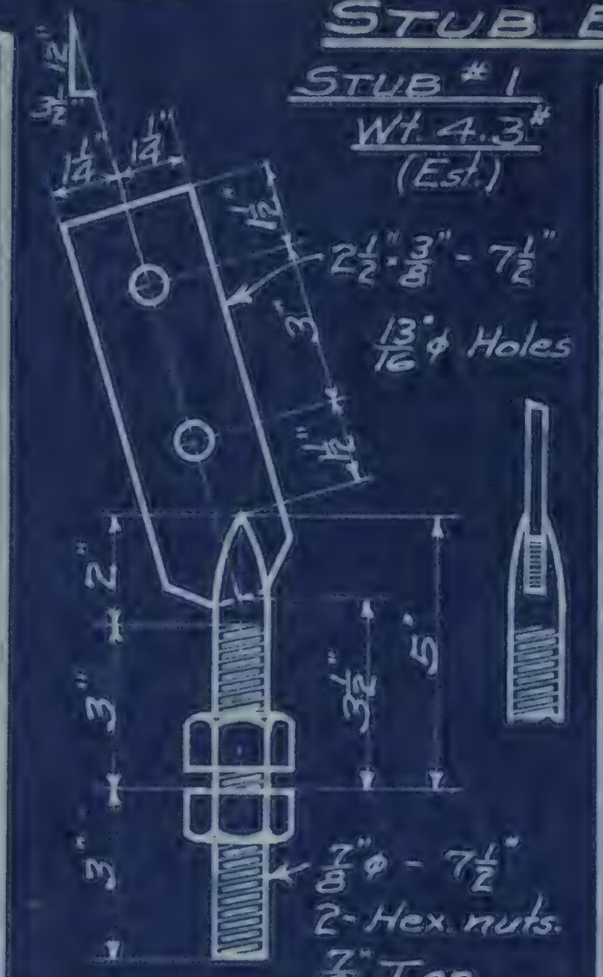
11-12-07

S 20.211a

STUB ENDS

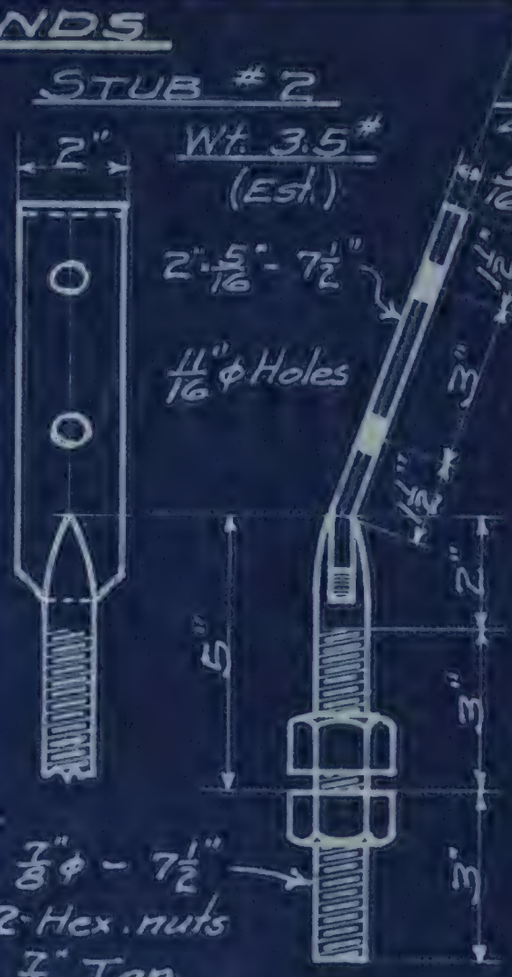
STUB # 1

Wt. 4.3# (Est.)



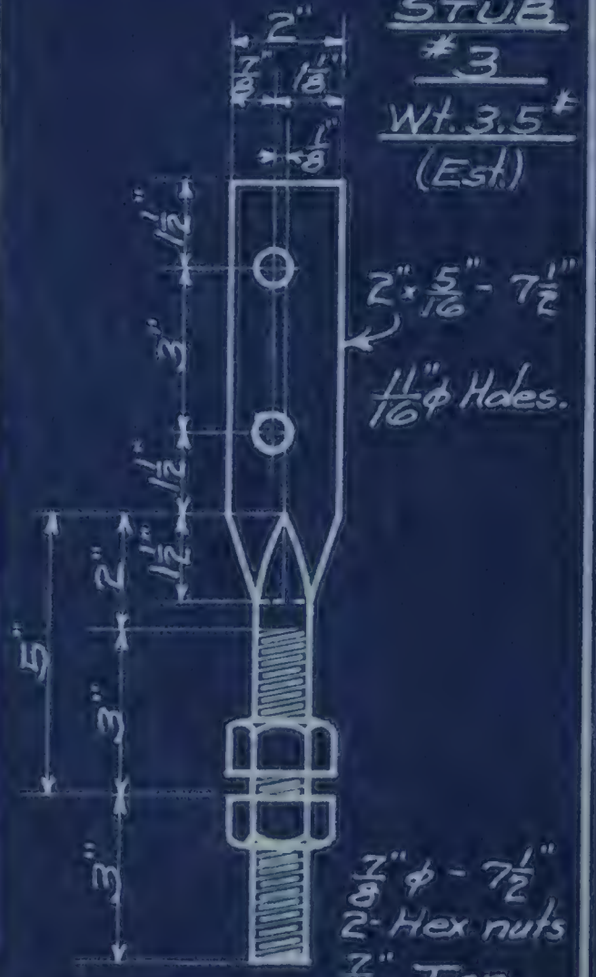
STUB # 2

Wt. 3.5# (Est.)



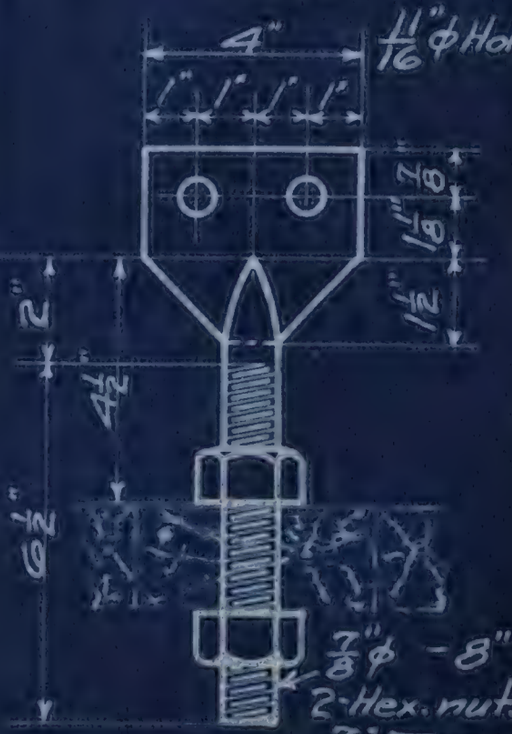
STUB # 3

Wt. 3.5# (Est.)



STUB # 4

Wt. 3.2# (Est.)



3-1-10

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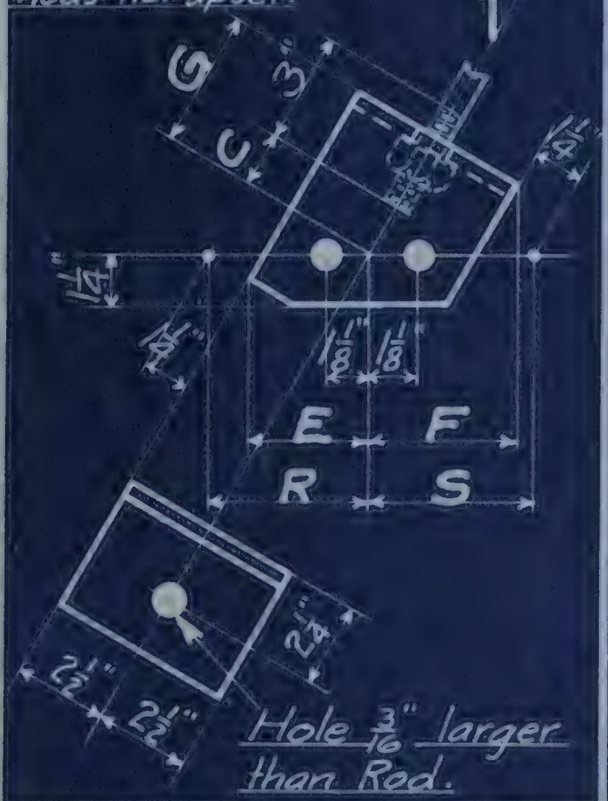
S23.011a

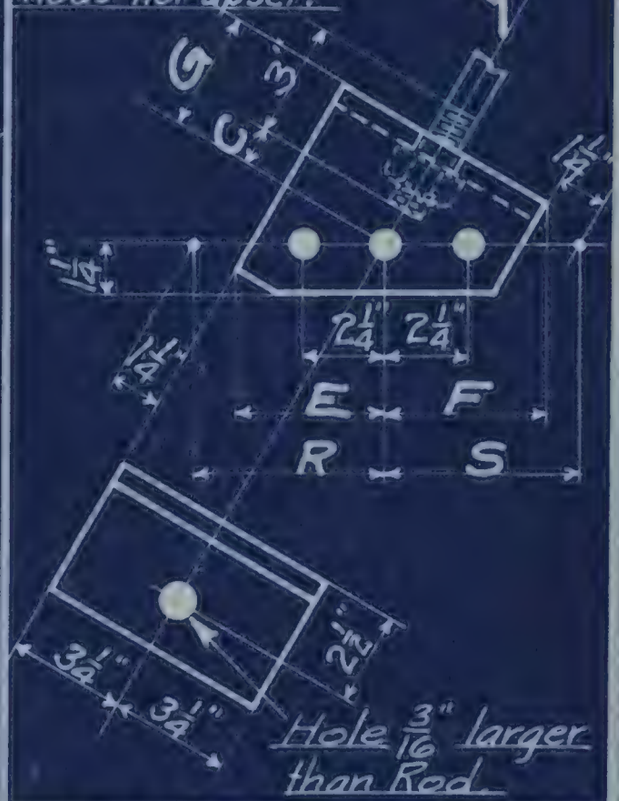
Sway Rod Connection Angles

Rods $\frac{3}{4}$"ϕ ; Bolts - $\frac{3}{4}$"ϕ or $\frac{5}{8}$"ϕ
Rods $\frac{7}{8}$"ϕ ; Bolts - $\frac{3}{4}$"ϕ or $\frac{5}{8}$"ϕ
Rods not upset.



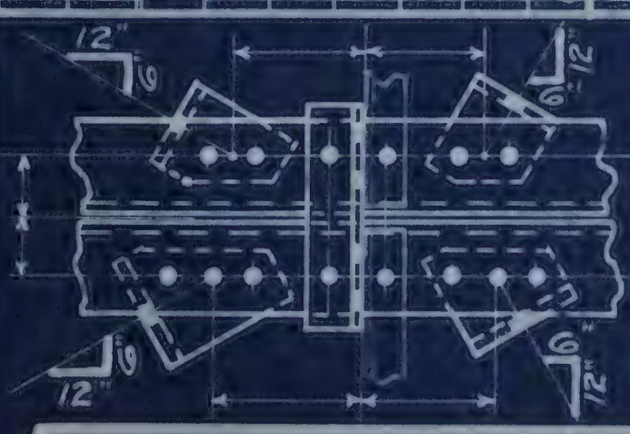
Hole $\frac{3}{16}$" larger than Rod.

Rods - 1"ϕ ; Bolts - $\frac{3}{4}$"ϕ or $\frac{5}{8}$"ϕ
Rods - 1⅛"ϕ ; Bolts - $\frac{3}{4}$"ϕ
Rods not upset.



Hole $\frac{3}{16}$" larger than Rod.

A	B	Ls	G	C	E	F	R	S	A	B	Ls	G	C	E	F	R	S
12	6	6"-4"-5"	3¾	1½	3 5/16	3 15/16	4 3/16	4 3/16	12	6	6"-6"-6" 6"-4"-5" 8"-4"-5" 8"-6"-6"	3¼	¾	4 3/16	4 3/8	5 1/16	5 1/16
12	7		"	"	3 3/8	4 1/16	4 5/16	4 3/8	12	7		"	"	4 1/4	4 7/16	5 1/4	5 1/4
12	8		"	"	3 7/16	4 3/16	4 1/2	4 1/2	12	8		"	"	4 5/16	4 1/2	5 7/16	5 7/16
12	9		"	"	"	4 1/4	4 5/8	4 11/16	12	9		"	"	"	4 9/16	5 9/16	5 11/16
12	10		"	"	"	4 5/16	4 11/16	4 7/8	12	10		"	"	"	"	"	5 3/4
12	11		"	"	3½	4 3/8	4¾	5 1/8	12	11		"	"	"	4 5/8	"	5 7/8
12	12		"	"	"	4 7/16	"	5 5/16	12	12		"	"	"	"	5½	"
11	12		"	"	3 7/16	4½	4 11/16	5½	11	12		4½	2	4 7/8	5 9/16	6 1/8	6 5/8
10	12		"	"	"	"	4 5/8	5 5/8	10	12		"	"	"	"	"	6 3/4
9	12		"	"	"	"	4 9/16	5 3/4	9	12		"	"	"	"	6 1/16	6 13/16
8	12		"	"	3 3/8	4 9/16	4 3/8	"	8	12		"	"	4 13/16	"	5 7/8	"
7	12		"	"	3 5/16	"	4 1/4	"	7	12		"	"	"	"	5 11/16	6 11/16
6	12		"	"	3¼	4½	4 1/16	5 5/8	6	12		"	"	4¾	5½	5 7/16	6 7/16



For Upset Rods and Rods over 1⅛" use Clevises.
Specify Hex Nuts on all Sway Rods.
Bolts can have Hex. or Sq. Heads and Nuts.

J.A.A. 1-29-11

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T1.031a

Lifting Capacity of Tackle.

Wooden Shell Blocks with Manila Rope.

Tackle fall pulls and loads lifted were accurately measured for each case from full sized tests. Tables deduced from experiments made at Pencoyd Plant Nov. 1902

These values are only for tackle as shown. If tackle fall is snatched or passes over additional sheaves, capacity is diminished.

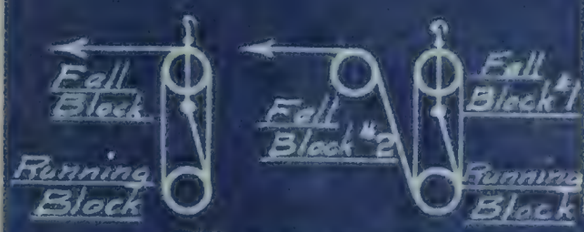
Working strength of Rope = Ultimate × ⅙ =

1¼" ϕ - 4300#; 1½" ϕ - 5900#; 1¾" ϕ - 7900#; 2" ϕ - 10300#; 2¼" ϕ - 13100#

Approx. pull on Tackle Fall =

1¼" ϕ - 4000#; 1½" ϕ - 6000#; 1¾" ϕ - 8000#; 2" ϕ - 10000#; 2¼" ϕ - 14000#

12" Block for 1¼" rope; 14" Block for 1½" rope; 16" Block for 1¾" rope; 20" Block for 2" + 2¼ ropes.



Capacity of Blocks

Size of Block	No. of Sheaves						
	Block with Hook			Block with Shackle			
	1	2	3	1	2	3	4
12"	5	7	8	In Tons			
14"	6	10	12				14
16"	8	12	15				20
20"				16	22	30	36

Tackle for Various Loads.

Load in Tons	Diam. of Rope	2-Block Tackle			3-Block Tackle			
		No. Sheaves		Plies of Rope	No. Sheaves			Plies of Rope
		Fall Block	Running Block		Fall Block #2	Fall Block #1	Running Block	
4	1¼	1	1	2	1	0	1	2
5	1¼	2	1	3	1	1	1	3
	1½	1	1	2	1	0	1	2
6	1¼	2	2	4	1	1	2	4
	1½	2	1	3	1	1	1	3
7	1¼	2	2	4	1	1	2	4
	1½	2	2	4	1	1	2	4
8	1¼	3	3	6	1	2	3	6
	1½	2	2	4	1	1	2	4
9	1½	2	2	4	1	1	2	4
10	1½	3	2	5	1	2	2	5
11	1½	3	3	6	1	2	3	6
	1¾	2	2	4	1	1	2	4
12	1½	3	3	6	1	2	3	6
	1¾	2	2	4	1	1	2	4
13	1½	4	4	8	1	3	4	8
	1¾	3	3	6	1	2	3	6
14	1½	4	4	8	1	3	4	8
	1¾	3	3	6	1	2	3	6
16	1¾	4	4	8	1	3	4	8
18	1¾	4	4	8	1	3	4	8
20	2	3	3	6	1	2	3	6
22	2	3	3	6	1	2	3	6
24	2	4	4	8	1	3	4	8
26	2	4	4	8	1	3	4	8
28	2				1	4	4	9
	2¼	3	3	6	1	2	3	6
30	2¼	4	4	8	1	3	4	8
35	2¼				1	4	4	9

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T.1.031b

LIFTING CAPACITY OF TACKLE

STEEL SHELL BLOCKS WITH STEEL ROPE

Rope ¾ ϕ best Crucible Steel (cast) Hoisting Rope, 19 wires to strand, 6 strands, and hemp core.

Ultimate strength = 46000 #

Least factor of safety = $\frac{46000}{16600} = 2.8$

Tackle fall pulls + loads lifted were accurately measured for each case from full sized tests. Experiments made of Pencoyd 1902

These values are only for tackle as shown. If lead line is snatched or passes over additional sheaves, capacity diminished.

TACKLE FOR VARIOUS LOADS

Load in Tons	Pull in Tons	Diam of Rope	2 Block Tackle			3 Block Tackle			
			Nº Sheaves		Plies of Rope	Nº Sheaves			Plies of Rope
			Fall Block	Running Block		Fall Block #2	Fall Block #1	Running Block	
10	3.7	¾	2	1	3	1	1	1	3
20	4.9	¾	3	2	5	1	2	2	5
30	5.8	¾	4	3	7	1	3	3	7
40	6.7	¾				1	4	4	9
60	8.3	¾				1	6	6	13

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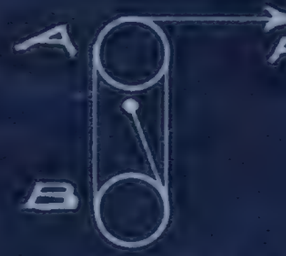
RATIOS OF LOAD TO PULL IN TACKLE.



A = Fall Block
B = Running Block
P = Tackle Fall

P = Pull in pounds on Tackle Fall.
W = Load " " lifted.
R = Factor - Load lifted per lb. pull.
a = No. of times tackle fall is snatched or passes over sheaves other than those in tackle blocks.

When Tackle Fall is Snatched: $W = \frac{P \times R}{1.20 \times a}$; $P = \frac{1.20 \times a \cdot W}{R}$

When Tackle Fall is not Snatched: $W = P \times R$; $P = \frac{W}{R}$

Example:- Engine pull on tackle fall - 10000* ; Rigging - 7 ply tackle of 1½" rope ; 2 snatch blocks ; 2 sheaves.

$W = \frac{10000 \times 4.89}{1.20 \times 4} = 23600^{\#}$ $\quad P = \frac{1.20 \times 4 \times 23600}{4.89} = 10000^{\#}$

LOAD LIFTED PER POUND PULL IN TACKLE FALL.

Diam. Rope	Working Load	Plies of Rope suspending Running Block 1	2	3	4	5	6	7	8	9	10	11	12	13	14
						Manila Rope									
¾	1900	0.86	1.93	2.73	3.84	4.12	4.71	5.23	5.71	6.12	6.50	6.83	7.14	7.40	7.64
⅞	2300	0.83	1.92	2.68	3.37	3.95	4.48	4.92	5.32	5.66	5.96	6.22	6.45	6.64	6.82
1	3100	0.87	1.93	2.74	3.50	4.16	4.77	5.30	5.80	6.23	6.63	6.98	7.30	7.58	7.85
1¼	4300	0.83	1.92	2.68	3.37	3.95	4.48	4.92	5.32	5.65	5.96	6.21	6.44	6.63	6.81
1½	5900	0.83	1.91	2.67	3.36	3.93	4.45	4.89	5.28	5.61	5.91	6.15	6.38	6.56	6.73
1¾	7900	0.81	1.91	2.64	3.30	3.84	4.33	4.72	5.08	5.37	5.64	5.85	6.04	6.20	6.34
2	10300	0.82	1.91	2.65	3.32	3.87	4.37	4.78	5.14	5.45	5.72	5.94	6.15	6.31	6.46
2¼	13100	0.80	1.90	2.63	3.28	3.80	4.28	4.65	5.00	5.27	5.52	5.72	5.90	6.04	6.17
						Wire Rope									
¾	16600	0.86	1.93	2.73	3.47	4.11	4.70	5.20	5.68	6.08	6.46	6.78	7.08	7.34	7.58

T.1.031c

· A.B.Co's Standard ·

As Approved:- 7-2-'09

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STANDARD TEES

"C" is figured for fibre stress of f = 16000 per □"

"C'" " " " " " " f = 12000 " " "

$C \text{ or } C' = \frac{8fS}{l^2}$

Safe Load (uniform) = $\frac{C \text{ or } C'}{\text{span (in Ft.)}}$

Size Flange by Stem	Properties (Carnegie Hand Book 1903) Wt per Ft.		FLANGE			STEM			Area	Dist to Axis XX	Axis XX			Axis YY			Axis XX	Axis YY
	Pen-coyd	Car-negie	Thk's t_f	Gage S_f	Max Rivet	Thk's t_s	Gage S_s	Max Rivet			M. Inert.	Sect. Mod.	Rad Gy.	M. Inert.	Sect. Mod.	Rad Gy.	Coef. Stgh.	Coef. Stgh.
										y	I	S	r	I'	S'	r'	C	C'
4 × 4	13.7	13.9	9/16	2½	5/8	9/16	2½	7/8	4.02	1.18	5.7	2.02	1.20	2.8	1.40	0.84	21550	16170
4 × 4	10.9	10.9	7/16	2½	"	7/16	"	"	3.21	1.15	4.7	1.64	1.23	2.2	1.09	0.84	17470	13100
3½ × 3½	11.0		½	2¼	½	½	2⅛	"										
3½ × 3½		11.2	9/16	"	"	9/16	"	"	3.45	1.06	3.7	1.52	1.04	1.89	1.08	0.74	16210	12160
3½ × 3½	9.0	9.3	7/16	"	"	7/16	"	"	2.70	1.01	3.0	1.19	1.05	1.42	0.81	0.73	12710	9530
3½ × 3½	7.0		11/32	"	"	11/32	"	"										
3 × 3		10.1	9/16	1⅞	"	9/16	1⅛	3/4	2.94	0.93	2.3	1.10	0.88	1.20	0.80	0.64	11710	8780
3 × 3		9.0	½	"	"	½	"	"	2.67	0.92	2.1	1.01	0.90	1.08	0.72	0.64	10810	8110
3 × 3	7.7	7.9	7/16	"	"	7/16	"	"	2.28	0.88	1.8	0.86	0.90	0.90	0.60	0.63	9200	6900
3 × 3	6.5	6.8	3/8			3/8			1.95	0.86	1.6	0.74	0.90	0.75	0.50	0.62	7870	5900
2½ × 2½	6.6		11/32	1⅜	⅝	11/32	1¼	5/8										
2½ × 2½		6.5	7/16	"	"	7/16	"	"	1.89	0.76	1.0	0.59	0.74	0.52	0.42	0.53	6270	4700
2½ × 2½	5.8		11/32	"	"	11/32	"	"										
2½ × 2½		5.6	3/8	"	"	3/8	"	"	1.62	0.74	0.87	0.50	0.74	0.44	0.35	0.52	5330	4000
2½ × 2½	5.0		11/32	"	"	11/32	"	"										
2½ × 2½		5.0	3/8	1⅜	"	3/8	1½	"	1.44	0.69	0.66	0.42	0.68	0.33	0.30	0.48	4480	3360
2½ × 2½	4.0	4.2	5/16	"	"	5/16	"	"	1.20	0.66	0.51	0.32	0.67	0.25	0.22	0.47	3450	2600
2 × 2		4.4	3/8	1¼	"	3/8	1⅜	½	1.26	0.63	0.45	0.33	0.60	0.23	0.23	0.43	3480	2610
2 × 2	3.5	3.7	5/16	"	"	5/16	"	"	1.08	0.59	0.36	0.25	0.60	0.18	0.18	0.42	2670	2000
1¾ × 1¾		3.2	5/16	1⅛	¼	5/16	1⅛	"	0.90	0.54	0.23	0.19	0.51	0.12	0.14	0.37	2050	1540
1¾ × 1¾	2.4		¼	"	"	¼	"	"										
1½ × 1½		2.6	9/32	1	"	9/32	1	⅜	0.75	0.42	0.15	0.14	0.49	0.08	0.10	0.34	1530	1150
1½ × 1½	2.0		¼	"	"	¼	"	"										
1½ × 1½		2.0	9/32	"	"	9/32	"	"	0.54	0.44	0.11	0.11	0.45	0.06	0.07	0.31	1150	860
1¼ × 1¼		2.1	9/32	1⅛	"	9/32	⅞	¼	0.60	0.40	0.08	0.10	0.36	0.05	0.07	0.27	1010	760
1¼ × 1¼	1.5		¼	"	"	¼	"	"										
1¼ × 1¼		1.7	7/32	"	"	7/32	"	"	0.45	0.38	0.06	0.07	0.37	0.03	0.05	0.26	750	560
1 × 1		1.3	7/32			7/32			0.36	0.32	0.03	0.05	0.29	0.02	0.04	0.21	490	370
1 × 1	1.0		¼			¼												
1 × 1		1.0	5/32			5/32			0.26	0.29	0.02	0.03	0.29	0.01	0.02	0.21	320	240

T.5.05.19

A.B.Co's Standard

As Approved, 7-2-'09

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STANDARD TEES

"C" is figured for fibre stress of f = 16000* per □" C or C' = $\frac{8fs}{12}$

"C'" " " " " " " f = 12000* " □" Safe Load (uniform) = $\frac{C \text{ or } C'}{\text{Span (in ft.)}}$

Size Flange by Stem	Properties (Carnegie Hand Book 1903)																
	Wt. per Ft.		Flange			Stem			Area	Dist. to Axis XX	Axis X X			Axis Y Y			Axis XX	Axis YY
	Per-coyd	Car-negie	Thk's t_F	Gage g_F	Max. Rivet	Thk's t_S	Gage g_S	Max. Rivet		y	M. Inert. I	Sec. Mod S	Rad. Gy. r	M. Inert. I'	Sec. Mod S'	Rad. Gy. r'	Coef. Stgh C	Coef. Stgh C'
5 × 4	15.3		9/16	3 1/2	3/4	9/16	2 1/2	7/8										
4 × 5		15.7	9/16	2 1/2	5/8	9/16	3	"	4.56	1.56	10.7	3.10	1.54	2.8	1.41	0.79	33070	24800
4 × 5		12.3	7/16	"	"	7/16	"	"	3.54	1.51	8.5	2.43	1.56	2.1	1.06	0.78	25880	19410
4 × 4 1/2	14.6	14.8	9/16	"	"	9/16	2 3/4	"	4.29	1.37	8.0	2.55	1.37	2.8	1.41	0.81	27200	20400
4 × 4 1/2	11.4	11.6	7/16	"	"	7/16	"	"	3.36	1.31	6.3	1.98	1.38	2.1	1.06	0.80	21120	15840
4 × 3	10.2		1/2	"	"	1/2	1 7/8	3/4										
4 × 3	9.0	9.3	7/16	"	"	7/16	"	"	2.73	0.78	2.0	0.86	0.86	2.1	1.05	0.88	9430	7070
3 1/2 × 4		12.8	9/16	2 1/4	1/2	9/16	2 1/2	7/8	3.75	1.25	5.5	1.98	1.21	1.89	1.08	0.72	21150	15870
3 1/2 × 4		10.0	7/16	"	"	7/16	"	"	2.91	1.19	4.3	1.55	1.22	1.42	0.81	0.70	16510	12380
3 1/2 × 3		11.0	9/16	"	"	9/16	1 7/8	3/4	3.21	0.88	2.4	1.13	0.87	1.88	1.08	0.77	12070	9050
3 1/2 × 3	8.5	8.7	7/16	"	"	7/16	"	"	2.49	0.83	1.9	0.88	0.86	1.41	0.81	0.75	9390	7040
3 1/2 × 3	7.0	7.1	3/8	"	"	3/8	"	"	2.28	0.78	1.6	0.72	0.89	1.18	0.68	0.76	7720	5790
3 × 4		11.9	9/16	2	"	9/16	2 1/2	7/8	3.48	1.32	5.2	1.94	1.23	1.21	0.81	0.59	20650	15480
3 × 4		10.6	1/2	"	"	1/2	"	"	3.12	1.32	4.8	1.78	1.25	1.09	0.72	0.60	19030	14270
3 × 4		9.3	7/16	"	"	7/16	"	"	2.73	1.29	4.3	1.57	1.26	0.93	0.62	0.59	16720	12540
3 × 3 1/2		11.0	9/16	"	"	9/16	2 1/4	"	3.21	1.12	3.5	1.49	1.06	1.10	0.80	0.62	15880	11910
3 × 3 1/2	9.5	9.8	1/2	"	"	1/2	"	"	2.88	1.11	3.3	1.37	1.08	1.31	0.88	0.68	14650	10990
3 × 3 1/2	8.3	8.6	7/16	"	"	7/16	"	"	2.49	1.09	2.9	1.21	1.09	0.93	0.62	0.61	12910	9680
3 × 2 1/2	7.0	7.2	7/16	"	"	7/16	1 5/8	3/8	2.10	0.71	1.1	0.60	0.72	0.89	0.60	0.66	6400	4800
3 × 2 1/2	6.0	6.2	3/8	"	"	3/8	"	"	1.80	0.68	0.94	0.52	0.73	0.75	0.50	0.65	5470	4100
3 × 2 1/2	5.0		5/16	"	"	5/16	"	"										
2 1/2 × 3		7.2	7/16	1 5/8	3/8	7/16	2	3/4	2.10	0.97	1.8	0.87	0.92	0.54	0.43	0.51	9280	6960
2 1/2 × 3	6.0	6.2	3/8	"	"	3/8	"	"	1.80	0.92	1.6	0.76	0.94	0.44	0.35	0.51	8150	6110

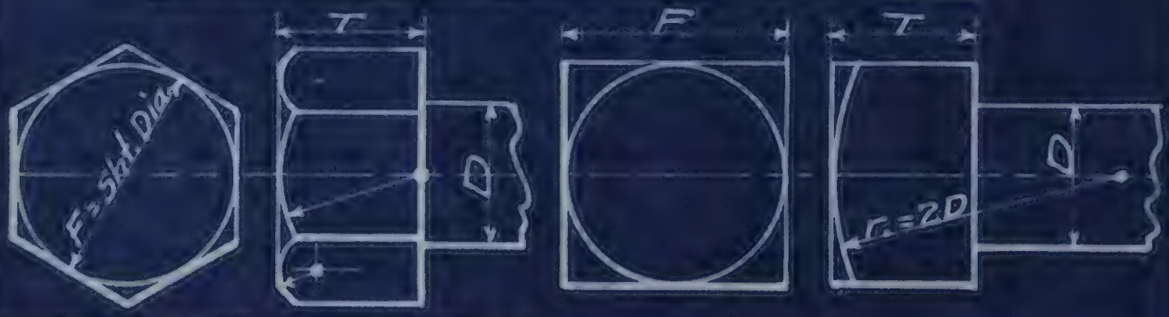
T.S.051.b

SCREW THREADS

SQ. THREAD "V" THREADS "V" THREADS

COVENTIONAL METHODS OF REPRESENTING SCREW THDS.

U.S. STD. HEADS + NUTS



	Rough or Black	Finished
F	1½ D + ⅛"	1½ D + 1/16
T	D	D − 1/16

D = Diam of Bolt.
F = Short dia. of Head or nut
T = Thickness " " " "

SHAPE of THREAD

U.S. Std. for Bolt Heads and Nuts, Shape and Pitch of Threads are same as recommended by the Franklin Inst. of Dec., 1864. The A.B.Co's Std is same as U.S. Std. except for the Pitch which is same as recommended by the American Railway Eng. + M. of W. Ass'n, 1905.

Diam. O	Area Sq. Ins.	U.S. Std. Dia. at Root of Thd	U.S. Std. Area at Root of Thd	U.S. Std. No of Thds per In.	A.B.Co's Std. Dia. of Root of Thd	A.B.Co's Std. Area at Root of Thd	A.B.Co's Std. No of Thds per In.
¼	.049	.185	.027	20	.185	.027	20
⅜	.110	.294	.068	16	.294	.068	16
½	.196	.400	.126	13	.400	.126	13
⅝	.307	.507	.202	11	.507	.202	11
¾	.442	.620	.302	10	.620	.302	10
⅞	.601	.731	.419	9	.731	.420	9
1	.785	.838	.551	8	.838	.551	8
1 ⅛	.994	.939	.693	7	.939	.693	7
1 ¼	1.227	1.064	.890	7	1.064	.890	7
1 ⅜	1.485	1.159	1.054	6	1.158	1.054	6
1 ½	1.767	1.284	1.294	6	1.283	1.294	6
1 ⅝	2.074	1.389	1.515	5½	1.408	1.558	6
1 ¾	2.405	1.490	1.744	5	1.533	1.677	6
1 ⅞	2.761	1.615	2.049	5	1.658	2.160	6
2	3.142	1.711	2.300	4½	1.783	2.498	6
2 ¼	3.976	1.961	3.021	4½	2.033	3.248	6
2 ½	4.909	2.175	3.716	4	2.283	4.095	6
2 ¾	5.940	2.425	4.620	4	2.533	5.041	6
3	7.069	2.629	5.428	3½	2.783	6.085	6
3 ¼	8.296	2.879	6.509	3½	3.033	7.227	6
3 ½	9.621	3.100	7.549	3¼	3.283	8.468	6

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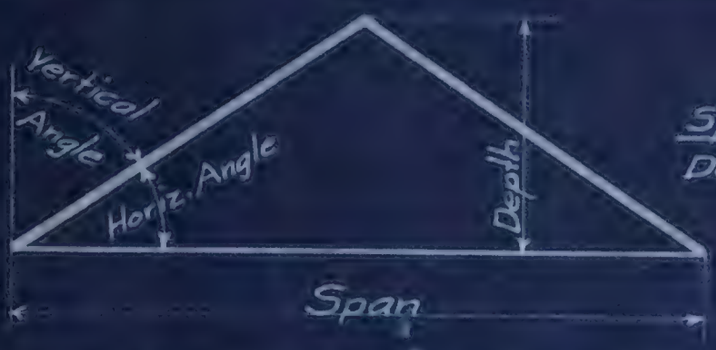


VERTICAL ANGLE

Pitch	Angle	Tan	Sec.	Sin	Cos	n
4"	71°-34'	3.000	3.162	.949	.316	6.0
5	67-23	2.400	2.600	.923	.385	4.8
6	63-26	2.000	2.236	.894	.447	4.0
7	59-45	1.714	1.985	.864	.504	3.43
8	56-19	1.500	1.803	.832	.554	3.0

HORIZONTAL ANGLE

Pitch	Angle	Tan.	Sec.	Sin	Cos	n
4"	18°-26'	.333	1.054	.316	.949	6.0
5	22-37	.417	1.083	.385	.923	4.8
6	26-34	.500	1.118	.447	.894	4.0
7	30-15	.583	1.158	.504	.864	3.43
8	33-41	.667	1.202	.555	.832	3.0

The Loads of 300# to 1000# are the total Loads per lineal ft. of Top Chords (including weight of trusses).

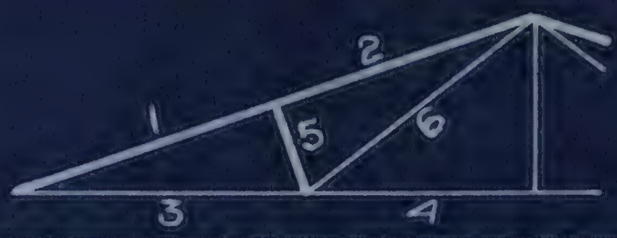
UNIT STRESSES:- Tension, 16000#; Compression, 16000# - 70 l/r, in which "l" = length in inches and "r" = least radius of gyration in inches. Max. l/r = 125. Two Angle members figured 3/8" b to b. ⊤⊤ for determining "r".

One rivet hole is deduced from each ∠ in tension; the diam. of hole taken at 1/8" larger than rivet. 5/8"ϕ rivets used for stresses of 50000# and less; 3/4"ϕ rivets used for stresses over 50000#.

In the Flat Trusses the stresses have been figured for an effect. depth at center of brg of 6/100 of span C. to C. bearings. For Std. Details of these trusses this effective end depth has been used as the dist. between working lines, the inner edges of chord ∠s being taken as the working lines.

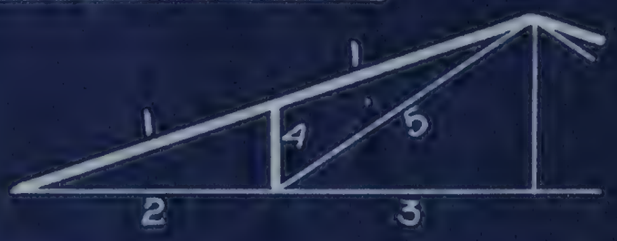
Single ∠ members in tension or comp. have been used for max. stress of 8/10 their value. Max. tension in single ∠ members = 12000#. Max. stress in 2-∠s 2½"-2"-¼" = 21000# for 3/4"ϕ rivets. Combined stresses in Top Chords having bending = 18000#, fibre stress from bending figured for 3/4 of the bending moment from a uniform load between panel points of 9/10 of the roof load.

Jaa
5-28-10



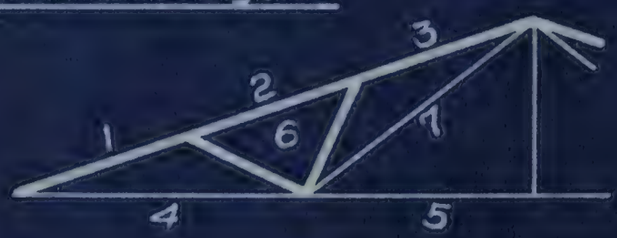
Member	4" Pitch	5" Pitch	6" Pitch	7" Pitch	8" Pitch
1	- 4.7	- 3.9	- 3.4	- 3.0	- 2.7
2	- 4.4	- 3.5	- 2.9	- 2.5	- 2.2
3	4.5	3.6	3.0	2.6	2.3
4	3.0	2.4	2.0	1.7	1.5
5	- 1.0	- 0.9	- 0.9	- 0.9	- 0.8
6	1.5	1.2	1.0	0.9	0.8

Stress = Coef. X Truss Panel Load



Member	4" Pitch	5" Pitch	6" Pitch	7" Pitch	8" Pitch
1	- 4.7	- 3.9	- 3.4	- 3.0	- 2.7
2	4.5	3.6	3.0	2.6	2.3
3	3.0	2.4	2.0	1.7	1.5
4	- 1.0	- 1.0	- 1.0	- 1.0	- 1.0
5	1.8	1.6	1.4	1.3	1.3

Compression is indicated by (-)



Member	4" Pitch	5" Pitch	6" Pitch	7" Pitch	8" Pitch
1	- 7.9	- 6.5	- 5.6	- 5.0	- 4.5
2	- 6.6	- 5.4	- 4.6	- 4.0	- 3.5
3	- 7.3	- 5.7	- 4.7	- 4.0	- 3.4
4	7.5	6.0	5.0	4.3	3.8
5	4.5	3.6	3.0	2.6	2.3
6	- 1.3	- 1.2	- 1.1	- 1.0	- 0.9
7	3.0	2.4	2.0	1.7	1.5

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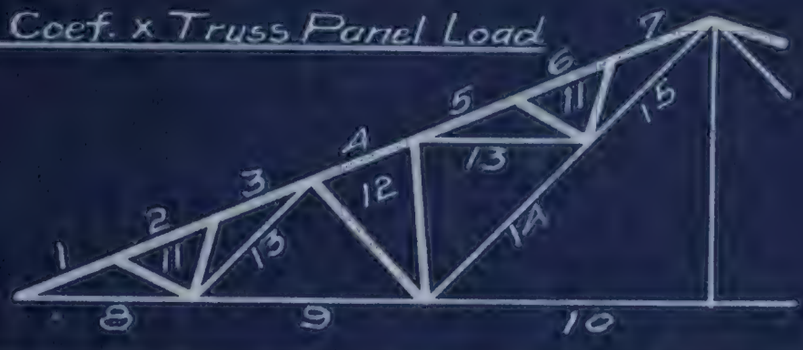
T/B.211 C

Stress = Coef. x Truss Panel Load



Member	4" Pitch	5" Pitch	6" Pitch	7" Pitch	8" Pitch
1	-20.6	-16.9	-14.5	-12.9	-11.7
2	-19.3	-15.8	-13.5	-11.9	-10.7
3	-19.9	-16.1	-13.7	-11.9	-10.6
4	-16.0	-12.9	-10.9	- 9.5	- 8.4
5	-19.3	-15.3	-12.8	-10.9	- 9.5
6	-18.0	-14.2	-11.7	- 9.9	- 8.5
7	-18.7	-14.6	-11.9	- 9.9	- 8.4
8	19.5	15.6	13.0	11.2	9.8
9	16.5	13.2	11.0	9.4	8.3
10	10.5	8.4	7.0	6.0	5.3
11	- 1.3	- 1.2	- 1.1	- 1.0	- 0.9
12	- 2.1	- 2.0	- 1.9	- 1.8	- 1.7
13	3.0	2.4	2.0	1.7	1.5
14	6.0	4.8	4.0	3.4	3.0
15	9.0	7.2	6.0	5.1	4.5

Compression is indicated by (-)

Member	4" Pitch	5" Pitch	6" Pitch	7" Pitch	8" Pitch
1	- 7.9	- 6.5	- 5.6	- 5.0	- 4.5
2	- 6.3	- 5.2	- 4.5	- 4.0	- 3.6
3	7.5	6.0	5.0	4.3	3.8
4	6.0	4.8	4.0	3.4	3.0
5	4.5	3.6	3.0	2.6	2.3
6	- 1.0	- 1.0	- 1.0	- 1.0	- 1.0
7	- 1.5	- 1.5	- 1.5	- 1.5	- 1.5
8	1.8	1.6	1.4	1.3	1.3
9	2.1	1.9	1.8	1.7	1.7

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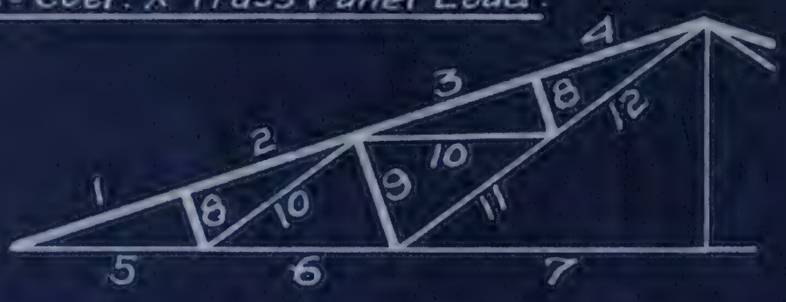
As Approved - 4-2-'18.

JAA 10/DL

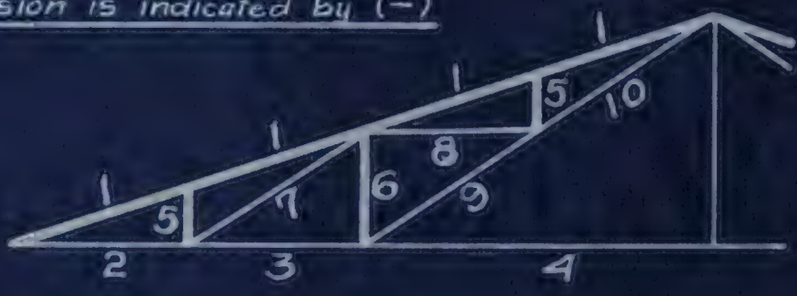
T19.211 d

Stress = Coef. X Truss Panel Load.



Member	4" Pitch	5" Pitch	6" Pitch	7" Pitch	8" Pitch
1	-11.1	- 9.1	- 7.8	- 7.0	- 6.3
2	-10.8	- 8.7	- 7.4	- 6.4	- 5.8
3	-10.4	- 8.3	- 6.9	- 5.9	- 5.2
4	-10.1	- 7.9	- 6.5	- 5.4	- 4.6
5	10.5	8.4	7.0	6.0	5.3
6	9.0	7.2	6.0	5.1	4.5
7	6.0	4.8	4.0	3.4	3.0
8	- 1.0	- 0.9	- 0.9	- 0.9	- 0.8
9	- 1.9	- 1.9	- 1.8	- 1.7	- 1.7
10	1.5	1.2	1.0	0.9	0.8
11	3.0	2.4	2.0	1.7	1.5
12	4.5	3.6	3.0	2.6	2.3

Compression is indicated by (-)



Member	4" Pitch	5" Pitch	6" Pitch	7" Pitch	8" Pitch
1	-11.1	- 9.1	- 7.8	- 7.0	- 6.3
2	10.5	8.4	7.0	6.0	5.3
3	9.0	7.2	6.0	5.1	4.5
4	6.0	4.8	4.0	3.4	3.0
5	- 1.0	- 1.0	- 1.0	- 1.0	- 1.0
6	- 2.0	- 2.0	- 2.0	- 2.0	- 2.0
7	1.8	1.6	1.4	1.3	1.3
8	1.5	1.2	1.0	0.9	0.8
9	3.6	3.1	2.8	2.6	2.5
10	5.4	4.7	4.2	4.0	3.8

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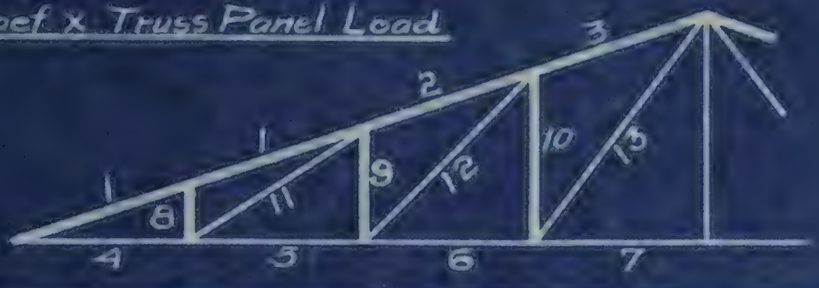
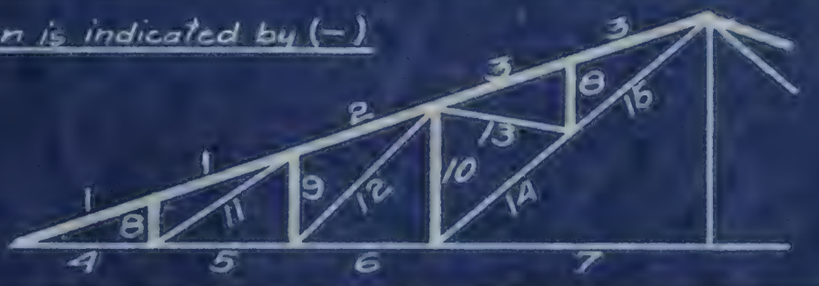
T 18.211 e

Stress = Coef x Truss Panel Load



Member	4" Pitch	5" Pitch	6" Pitch	7" Pitch	8" Pitch
1	-11.1	- 9.1	- 7.8	- 7.0	- 6.3
2	- 9.5	- 7.8	- 6.7	- 6.0	- 5.4
3	- 7.9	- 6.5	- 5.6	- 5.0	- 4.5
4	10.5	8.4	7.0	6.0	5.3
5	9.0	7.2	6.0	5.1	4.5
6	7.5	6.0	5.0	4.3	3.8
7	6.0	4.8	4.0	3.4	3.0
8	- 1.0	- 1.0	- 1.0	- 1.0	- 1.0
9	- 1.5	- 1.5	- 1.5	- 1.5	- 1.5
10	- 2.0	- 2.0	- 2.0	- 2.0	- 2.0
11	1.8	1.6	1.4	1.3	1.3
12	2.1	1.9	1.9	1.7	1.7
13	2.5	2.3	2.2	2.2	2.1

Compression is indicated by (-)



Member	4" Pitch	5" Pitch	6" Pitch	7" Pitch	8" Pitch
1	-14.2	-11.7	-10.1	- 8.9	- 8.1
2	-12.7	-10.4	- 9.0	- 7.9	- 7.2
3	-12.1	-10.0	- 8.6	- 7.6	- 6.9
4	13.5	10.7	9.0	7.7	6.8
5	12.0	9.6	8.0	6.9	6.0
6	10.5	8.4	7.0	6.0	5.3
7	7.5	6.0	5.0	4.3	3.8
8	- 1.0	- 1.0	- 1.0	- 1.0	- 1.0
9	- 1.5	- 1.5	- 1.5	- 1.5	- 1.5
10	- 2.5	- 2.5	- 2.5	- 2.5	- 2.5
11	1.8	1.6	1.4	1.3	1.3
12	2.1	1.9	1.9	1.7	1.7
13	1.0	0.8	0.7	0.6	0.5
14	3.9	3.5	3.2	3.0	2.9
15	5.2	4.6	4.3	4.0	3.9

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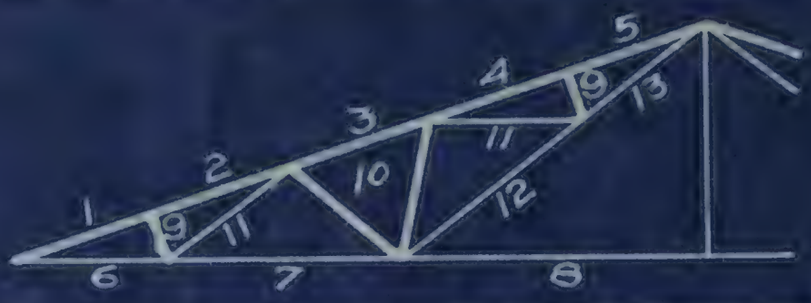
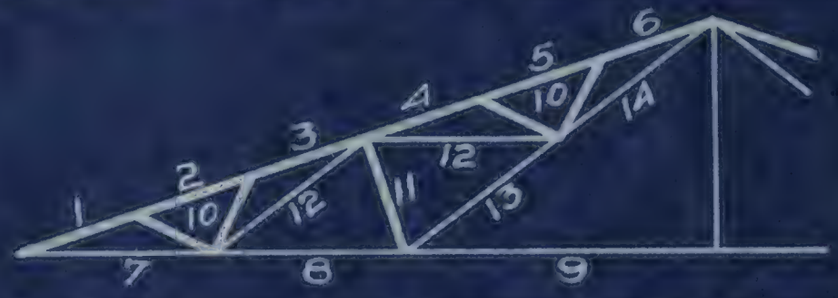
T 18.211 f



Member	4" Pitch	5" Pitch	6" Pitch	7" Pitch	8" Pitch
1	- 14.2	- 11.7	- 10.1	- 8.9	- 8.1
2	- 13.9	- 11.3	- 9.6	- 8.4	- 7.6
3	- 11.3	- 9.2	- 7.7	- 6.7	- 6.0
4	- 13.3	- 10.5	- 8.7	- 7.4	- 6.4
5	- 13.0	- 10.2	- 8.3	- 6.9	- 5.9
6	13.5	10.7	9.0	7.7	6.8
7	12.0	9.6	8.0	6.9	6.0
8	7.5	6.0	5.0	4.3	3.8
9	- 1.0	- 0.9	- 0.9	- 0.9	- 0.8
10	- 1.7	- 1.5	- 1.5	- 1.4	- 1.3
11	1.5	1.2	1.0	0.9	0.8
12	4.5	3.6	3.0	2.6	2.3
13	6.0	4.8	4.0	3.4	3.0



Member	4" Pitch	5" Pitch	6" Pitch	7" Pitch	8" Pitch
1	- 17.4	- 14.3	- 12.3	- 10.9	- 9.9
2	- 16.1	- 13.2	- 11.3	- 9.9	- 8.9
3	- 16.8	- 13.5	- 11.4	- 9.9	- 8.8
4	- 16.5	- 13.1	- 11.0	- 9.4	- 8.3
5	- 15.2	- 12.0	- 9.9	- 8.4	- 7.3
6	- 15.8	- 12.4	- 10.1	- 8.4	- 7.1
7	16.5	13.2	11.0	9.4	8.3
8	13.5	10.7	9.0	7.7	6.8
9	9.0	7.2	6.0	5.1	4.5
10	- 1.3	- 1.2	- 1.1	- 1.0	- 0.9
11	- 2.9	- 2.8	- 2.7	- 2.6	- 2.5
12	3.0	2.4	2.0	1.7	1.5
13	4.5	3.6	3.0	2.6	2.3
14	7.5	6.0	5.0	4.3	3.8

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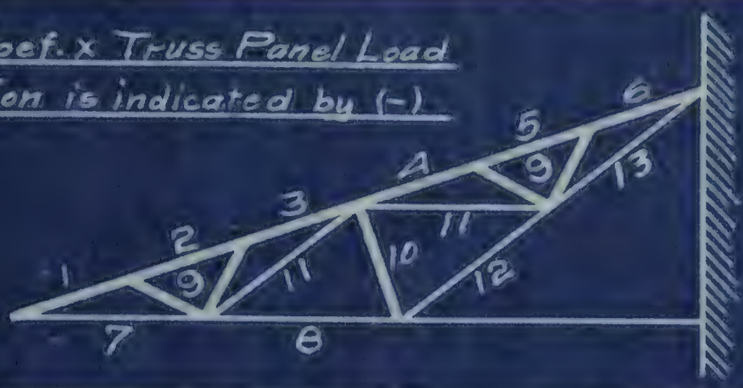
A.R.C.O's Standard
As Approved, 4-2-08

J.A.M.

T 18.211 $

Stress = Coef. x Truss Panel Load

Compression is indicated by (-)



Member	4" Pitch	5" Pitch	6" Pitch	7" Pitch	8" Pitch
1	- 7.9	- 6.5	- 5.6	- 5.0	- 4.5
2	- 6.6	- 5.4	- 4.6	- 4.0	- 3.5
3	- 7.3	- 5.7	- 4.7	- 4.0	- 3.4
4	- 7.0	- 5.3	- 4.3	- 3.5	- 2.8
5	- 5.7	- 4.2	- 3.3	- 2.5	- 1.9
6	- 6.3	- 4.6	- 3.4	- 2.4	- 1.7
7	7.5	6.0	5.0	4.3	3.8
8	4.5	3.6	3.0	2.6	2.3
9	- 1.3	- 1.2	- 1.1	- 1.0	- 0.9
10	- 2.9	- 2.8	- 2.7	- 2.6	- 2.5
11	3.0	2.4	2.0	1.7	1.5
12	4.5	3.6	3.0	2.6	2.3
13	7.5	6.0	5.0	4.3	3.8

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J.A.A.
4/18/06

T 18.211 h

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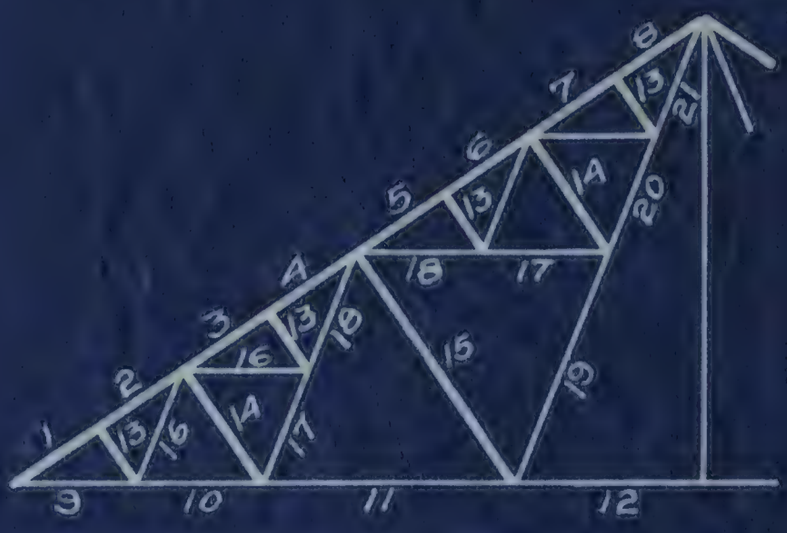


Stress = Coef. x Truss Panel Load.

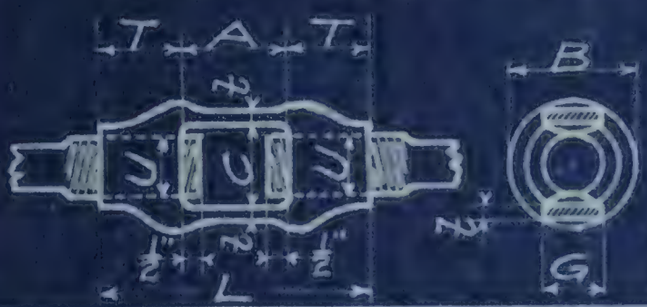
Compression is indicated by (-)

Member	4" Pitch	5" Pitch	6" Pitch	7" Pitch	8" Pitch
1	-23.7	-19.5	-16.8	-14.9	-13.5
2	-23.4	-19.1	-16.3	-14.4	-13.0
3	-23.1	-18.7	-15.9	-13.9	-12.4
4	-22.8	-18.3	-15.4	-13.4	-11.9
5	-22.5	-17.9	-15.0	-12.9	-11.3
6	-22.2	-17.6	-14.5	-12.4	-10.7
7	-21.8	-17.2	-14.1	-11.9	-10.2
8	-21.5	-16.8	-13.7	-11.4	-9.6
9	22.5	18.0	15.0	12.9	11.3
10	21.0	16.8	14.0	12.0	10.5
11	18.0	14.4	12.0	10.3	9.0
12	12.0	9.6	8.0	6.9	6.0
13	- 1.0	- 0.9	- 0.9	- 0.9	- 0.8
14	- 1.9	- 1.9	- 1.8	- 1.7	- 1.7
15	- 3.8	- 3.7	- 3.6	- 3.5	- 3.3
16	1.5	1.2	1.0	0.9	0.8
17	3.0	2.4	2.0	1.7	1.5
18	4.5	3.6	3.0	2.6	2.3
19	6.0	4.8	4.0	3.4	3.0
20	9.0	7.2	6.0	5.1	4.5
21	10.5	8.4	7.0	6.0	5.3

A.K. J.R.B. 10/06

T21.181a

TURN-BUCKLES



For upsets see sheets U17.191a-b

A=6" + =9" for turn-buckles marked #

Dia. of Screw U	Standard Dimensions T	L	C	t	G	B	Weight lbs.
3/8	9/16	7 1/8	9/16	3/16	1/2	1 1/16	1
7/16	21/32	7 5/16	5/8	1/4	5/8	1 3/8	1
1/2	3/4	7 1/2	5/8	1/4	5/8	1 3/8	1
9/16	27/32	7 11/16	13/16	5/16	3/4	1 9/16	1 1/2
5/8	15/16	7 7/8	13/16	5/16	3/4	1 9/16	1 1/2
3/4	1 1/8	8 1/4	1 1/16	11/32	7/8	2	2
7/8	1 5/16	8 5/8	1 1/4	3/8	1	2 1/4	3
1	1 1/2	9	1 5/16	7/16	1 1/4	2 7/16	4
1 1/8	1 11/16	9 3/8	1 7/16	1/2	1 1/4	2 9/16	5
1 1/4	1 7/8	9 3/4	1 9/16	1/2	1 1/2	2 3/4	6
1 3/8	2 1/16	10 1/8	1 11/16	1/2	1 5/8	3 1/16	7
1 1/2	2 1/4	10 1/2	1 3/4	5/8	1 3/4	3 3/16	8
1 5/8	2 7/16	10 7/8	2	5/8	1 7/8	3 1/2	10
1 3/4	2 5/8	11 1/4	2 1/8	5/8	2	3 3/4	11
1 7/8	2 13/16	11 5/8	2 3/16	11/16	2 1/8	3 7/8	12
2	3	12	2 3/8	11/16	2 1/4	4 1/4	14
2 1/8	3 3/16	12 3/8	2 1/2	23/32	2 1/2	4 1/2	17
2 1/4	3 3/8	12 3/4	2 11/16	13/16	2 1/2	4 3/4	20
2 3/8	3 9/16	13 1/8	2 3/4	13/16	2 3/4	4 7/8	22
2 1/2	3 3/4	13 1/2	3 1/16	27/32	3	5 3/8	25
2 5/8	3 15/16	13 7/8	3 1/8	15/16	3	5 3/16	30
2 3/4	4 1/8	14 1/4	3 1/4	15/16	3 1/4	5 3/4	33
2 7/8	4 5/16	14 5/8	3 7/16	1 1/32	3 1/4	6 1/16	36
3	4 1/2	15	3 5/8	1 1/32	3 1/2	6 3/8	40
3 1/4	4 7/8	15 3/4	3 7/8	1 1/16	4	6 3/4	50
3 1/2	5 1/4	16 1/2	4 1/4	1 7/32	4	7 1/4	65
3 3/4	5 5/8	17 1/4	4 7/16	1 5/16	5	8 1/4	95
4	6	18	4 5/8	1 7/16	5	8 3/4	108
# 4 1/4	6 1/4	21 1/2	4 5/8	1 5/8	5 5/32	9 1/4	140
# 4 1/2	6 3/4	22 1/2	5 1/2	1 3/4	6 1/2	10 3/4	195
# 4 3/4	7 1/4	23 1/2	5 5/8	2	6 1/2	11 1/4	205
# 5	7 1/2	24	6	2 1/4	6 1/2	11 7/8	250

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As Approved, 6-12-07.
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A.N. Jour. 1-24-10.

U17.191 a

STANDARD UPSETS
ROUND BARS

Upsets marked # are special.
Shape of Thread is same as recommd by the Franklin Institute of 1864. The Pitch is same as recommd by the American Railway Eng. & M. W. Ass. 1905.
All Dimensions given in Ins.

Diam. of Screw Ends	1"	1 1/8" + 1 1/4"	1 3/8" + UP
Threads per In.	8	7	6

ROD			UPSET					
Diam.	Area	Wt. per Foot Lbs	Diam.	Length	Add'l Lgth for upset + to Bar	Diam. at root of Thread	Area at root of Thread	Excess over area of bar %
# 5/8	.307	1.04	7/8	4	4 1/2	.731	.420	37.0
# 3/4	.442	1.50	1	4	4	.838	.551	24.7
# 7/8	.601	2.04	1 1/8	4	3 1/2	.939	.693	15.3
1	.785	2.67	1 3/8	4	4 1/2	1.158	1.054	34.2
1 1/8	.994	3.38	1 1/2	4	4	1.283	1.294	30.2
1 1/4	1.227	4.17	1 5/8	4	3 1/2	1.408	1.558	27.0
1 3/8	1.485	5.05	1 3/4	4	3 1/2	1.533	1.847	24.4
1 1/2	1.767	6.01	1 7/8	4 1/2	3 1/2	1.658	2.160	22.3
1 5/8	2.074	7.05	2	4 1/2	3	1.783	2.498	20.5
1 3/4	2.405	8.18	2 1/8	4 1/2	3	1.908	2.861	18.9
1 7/8	2.761	9.39	2 1/4	5	3	2.033	3.248	17.6
2	3.142	10.68	2 3/8	5	3	2.158	3.659	16.5
2 1/8	3.547	12.06	2 1/2	5 1/2	3	2.283	4.095	15.5
2 1/4	3.976	13.52	2 3/4	5 1/2	4	2.533	5.041	26.8
2 3/8	4.430	15.06	2 7/8	6	4	2.658	5.551	25.3
2 1/2	4.909	16.69	3	6	3 1/2	2.783	6.085	24.0
2 5/8	5.412	18.40	3 1/4	6 1/2	4 1/2	3.033	7.227	33.4
2 3/4	5.940	20.19	3 1/4	6 1/2	3 1/2	3.033	7.227	21.7
2 7/8	6.492	22.07	3 1/2	7	4 1/2	3.283	8.468	30.4
3	7.069	24.03	3 1/2	7	3 1/2	3.283	8.468	19.8
3 1/8	7.670	26.08	3 3/4	7	4 1/2	3.533	9.806	27.9
3 1/4	8.296	28.21	3 3/4	7	3 1/2	3.533	9.806	18.2
3 3/8	8.946	30.42	4	7 1/2	4 1/2	3.783	11.243	25.7
3 1/2	9.621	32.71	4	7 1/2	3 1/2	3.783	11.243	16.9
3 5/8	10.321	35.09	4 1/4	8	4 1/2	4.033	12.778	23.8
3 3/4	11.045	37.55	4 1/4	8	3 1/2	4.033	12.778	15.7
3 7/8	11.793	40.10	4 1/2	8 1/2	4 1/2	4.283	14.411	22.2

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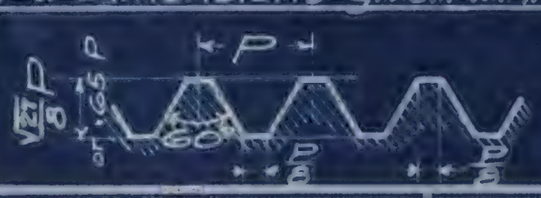
A.R.E.A. Standard
As Approved - 10-19-09.

7-10

U17.191 b

Standard Upsets
Square Bars

Upsets marked ‡ are special.
Shape of Thread is same as recommd by Franklin Institute, 1864. The Pitch is same as recommd by the American Railway Eng. + M.W. Ass., 1905.
All Dimensions given in Ins.



Diam. of Screw Ends	1"	1 1/8 + 1/4	1 3/8 + UP
Threads per In.	8	7	6

Rod			Upset					
Side of Bar	Area	Wt. per Foot Lbs	Diam.	Length	Addl length for upset + 10 %	Diam. at root of Thread	Area at root of Thread	Excess over area of Bar %
‡ 3/4	.563	1.91	1 1/8	4	4	.939	.693	23.2
‡ 7/8	.766	2.60	1 1/4	4	3 1/2	1.064	.890	16.2
1	1.000	3.40	1 1/2	4	4	1.283	1.294	29.4
1 1/8	1.266	4.30	1 5/8	4	3 1/2	1.408	1.558	23.1
1 1/4	1.563	5.31	1 7/8	4 1/2	4 1/2	1.658	2.160	38.3
1 3/8	1.891	6.43	2	4 1/2	4	1.783	2.498	32.1
1 1/2	2.250	7.65	2 1/4	5	5	2.033	3.248	44.3
1 5/8	2.641	8.98	2 3/8	5	4 1/2	2.158	3.659	38.6
1 3/4	3.063	10.41	2 1/2	5 1/2	4 1/2	2.283	4.095	33.7
1 7/8	3.516	11.95	2 3/4	5 1/2	5	2.533	5.041	43.4
2	4.000	13.60	2 7/8	6	5	2.658	5.551	38.8
2 1/8	4.516	15.35	3	6	4 1/2	2.783	6.085	34.8
2 1/4	5.063	17.21	3 1/4	6 1/2	5 1/2	3.033	7.227	42.7
2 3/8	5.641	19.18	3 1/2	7	6 1/2	3.283	8.468	50.1
2 1/2	6.250	21.25	3 3/4	7	7	3.533	9.806	56.9
2 5/8	6.891	23.43	3 3/4	7	5 1/2	3.533	9.806	42.3
2 3/4	7.563	25.71	4	7 1/2	6 1/2	3.783	11.243	48.7
2 7/8	8.266	28.10	4 1/4	8	7 1/2	4.033	12.778	54.6
3	9.000	30.60	4 1/4	8	6	4.033	12.778	42.0
3 1/8	9.766	33.20	4 1/2	8 1/2	7	4.283	14.411	47.6
3 1/4	10.563	35.91	4 3/4	8 1/2	7 1/2	4.533	16.142	52.8

A.R.Co's Standard.
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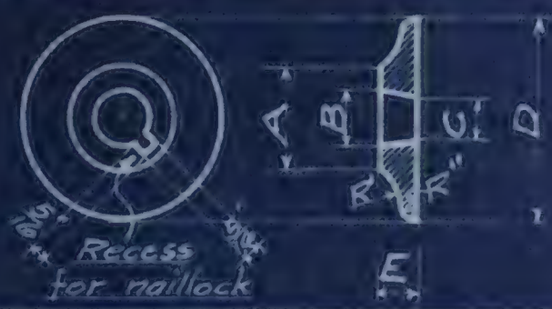
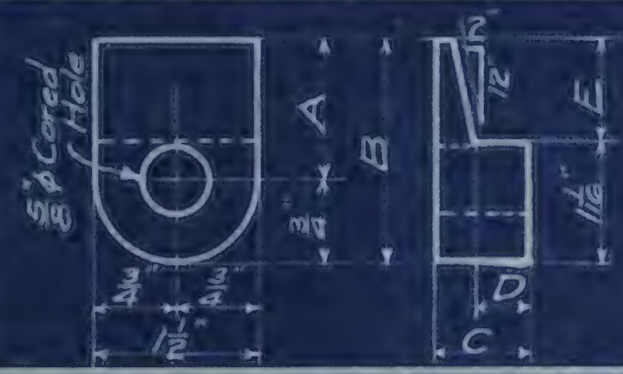
CAST IRON WASHERS & BM CLAMP

OGEE WASHER



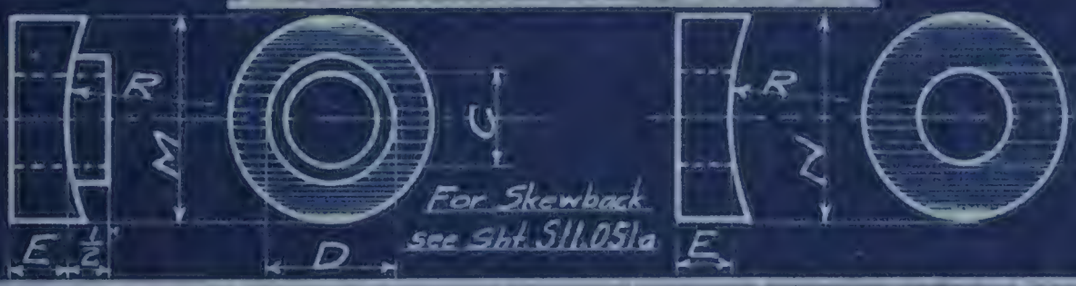
Size of Bolt	A	B	C	D	E	R'	R"	Patt No	Wt Lbs.
5/8	1 3/8	3/4	11/16	2 3/4	1/2	5/8	3/16	A91	.41
3/4	1 5/8	7/8	13/16	3 1/4	5/8	3/4	7/32	.92	.7
7/8	1 7/8	1 1/16	31/32	3 3/4	3/4	7/8	1/4	.93	1.0

BEAM CLAMP



Size of Beam	A	B	C	D	E	Pattern No	Wt Lbs
18	1 1/2	2 1/4	7/8	5/32	1 3/16	A 52	.4
15	"	"	"	13/32	"	53	"
12	"	"	"	11/32	"	54	"
10	"	"	3/4	5/16	"	55	.36
9	"	"	"	"	"	55	"
8	1 1/4	2	"	1/4	15/16	56	"
7	"	"	"	"	"	56	"
6	"	"	5/8	7/32	"	57	.29
5	"	"	"	"	"	57	"

SKEWBACK WASHERS



Used With	M	N	C	D	E	R	Patt No	Wt Lbs.
A Skewback	2 3/4		1 1/4	1 5/8	3/4	3 13/16	A81	1.2
		3 1/4	1 1/2		7/8	"	82	1.75
		3 3/4	1 3/4		1	"	83	2.5
B Skewback	3 3/4		1 3/4	2 1/8	1	4 5/16	84	2.7
		4	2		1	"	85	3.0
		4 1/2	2 1/4		1	"	86	3.9

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As Approved. 4-8-09.

- A.R.Co's Standard -

As Approved:- 5-13-09.

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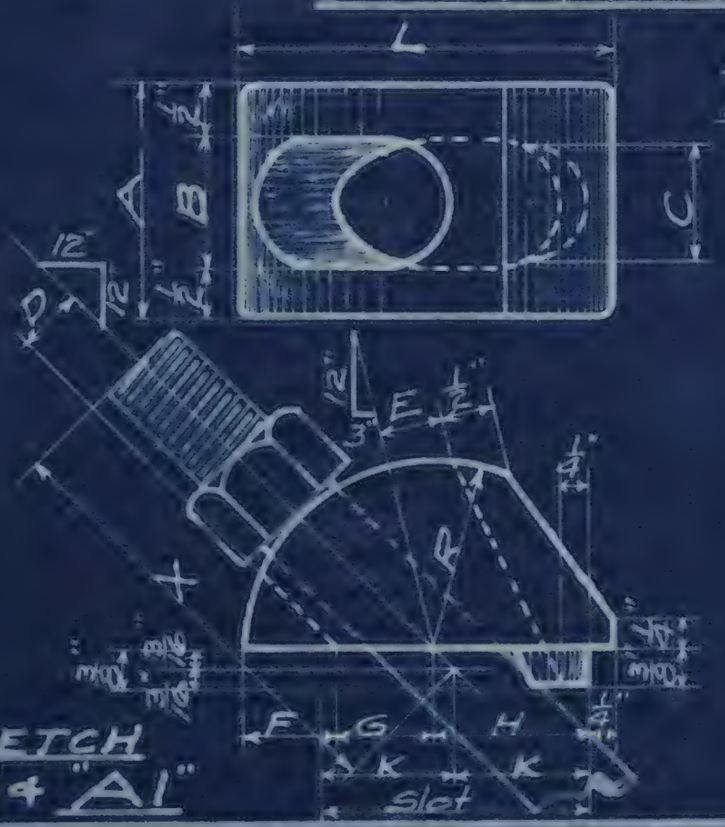
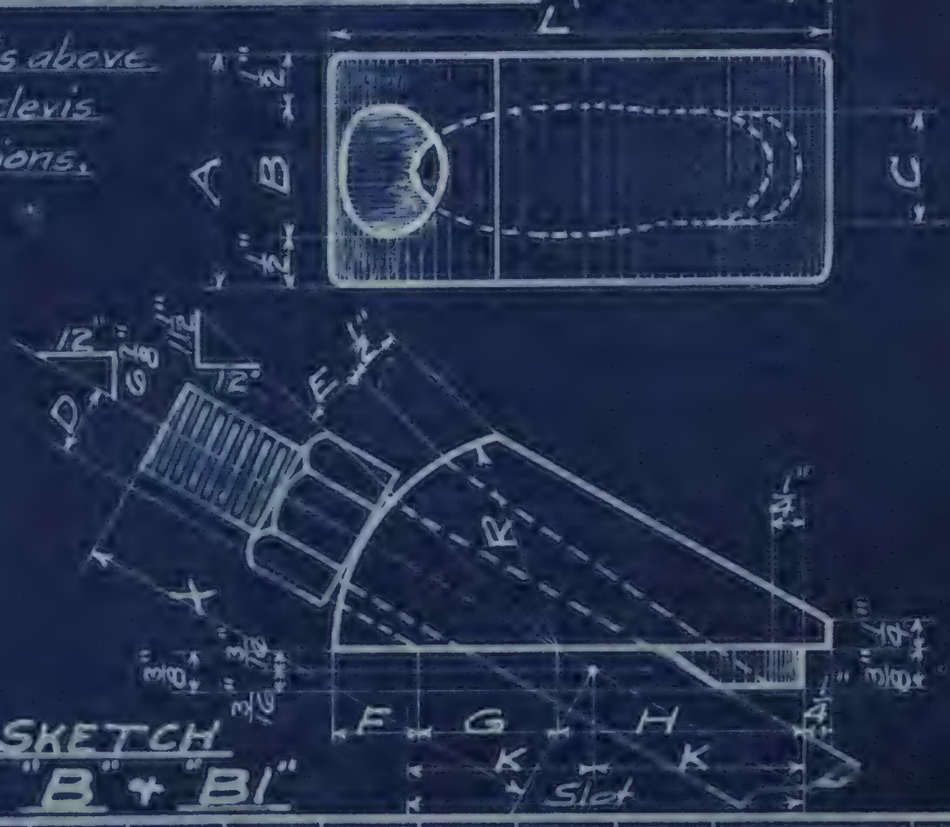
CAST IRON BEVELED WASHERS (for Mill Bldgs)

For Rods above 1 1/8" ϕ use clevis connections.



SKETCH "A" + "A1"



SKETCH "B" + "B1"

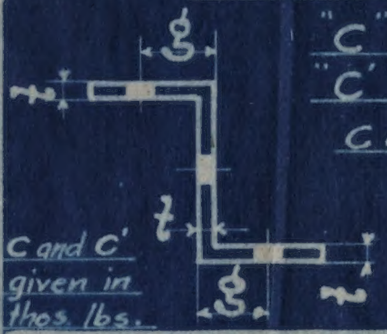
Sketch	Patt. No	O Rod	Upset	A	B	C	D	E	F	G	H	L	R	X	K	Size of Slot in Pl.	Wt.
A	A11	7/8 + 1	None	2 1/8	1 1/8	1	9/16	9/16	7/8	7/8	1 3/8	3 3/8	1 3/4	4	1 1/8	1 1/8 × 2 1/4	1.8
A1	-12	1 + 1 1/8	1 3/8 + 1 1/2	2 5/8	1 5/8	1 1/2	13/16	13/16	7/8	1 1/8	1 7/8	4 1/8	2	5	1 5/8	1 3/4 × 3 1/4	2.6
B	-13	7/8 + 1	None	2 1/8	1 1/8	1	9/16	9/16	3/4	1 1/4	2 1/4	4 1/2	2	4 1/2	1 1/4	1 1/8 × 3 1/2	2.3
B1	-14	1 + 1 1/8	1 3/8 + 1 1/2	2 5/8	1 5/8	1 1/2	13/16	13/16	3/4	1 1/8	3 1/8	6	2 5/8	6	2 5/8	1 3/4 × 5 1/4	3.8

W.I. 1924

Z

Z5.051

STANDARD "Z" BARS



"C" is figured for Fibre Stress of $f = 16000$ # per □"

"C'" " " " " " " " $f = 12000$ " " "

C or C' = $\frac{8fS}{12}$; Safe Load (uniform) = $\frac{\text{C or C'}}{\text{span (in ft.)}}$

C and C' given in thos. lbs.

Additional 3" Pencoyd Sections

- 3 1/8" × 2 3/4" × 3/8" — ℄ = 1 1/2"
- 3" × 2 21/32" × 7/16" — " = 1 5/8
- 3 1/32" × 2 11/16" × 15/32" — " = "
- 3 1/16" × 2 23/32" × 1/2 — " = "

Nominal Size	Web - Width	Flange Widths: Pencoyd	Flange Widths: Carnegie	Thickness t	Wt per Ft.	Area	℄ Gauge	Max. Rivet: Flange	Max. Rivet: Web	Properties (Carnegie Hand Book 1903)								
										Mom. Inertia I		Sect. Modul. S		Rad. Gyration r			Coef. Strength C	C'
										x-x	y-y	x-x	y-y	x-x	y-y	z-z	x-x	x-x
6	6	3 1/2	3 1/2	3/8	15.6	4.59	2 1/4	7/8	7/8	25.32	9.11	8.44	2.75	2.35	1.41	0.83	90.0	67.5
	6 1/16	3 9/16	3 9/16	7/16	18.3	5.39	"	"	"	29.80	10.95	9.83	3.27	2.35	1.43	0.84	104.8	78.6
	6 1/8	3 5/8	3 5/8	1/2	21.0	6.19	"	"	"	34.36	12.87	11.22	3.81	2.36	1.44	0.84	119.7	89.8
	6	3 1/2	3 1/2	9/16	22.7	6.68	"	"	"	34.64	12.59	11.52	3.91	2.28	1.37	0.81	123.2	92.4
	6 1/16	3 9/16	3 9/16	5/8	25.4	7.46	"	"	"	38.86	14.42	12.82	4.43	2.28	1.39	0.82	136.7	102.6
	6 1/8	3 5/8	3 5/8	11/16	28.0	8.25	"	"	"	43.18	16.34	14.10	4.98	2.29	1.41	0.84	150.4	112.8
	6	3 1/2	3 1/2	3/4	29.3	8.63	"	"	"	42.12	15.44	14.04	4.94	2.21	1.34	0.81	149.8	112.3
	6 1/16	3 9/16	3 9/16	13/16	31.9	9.40	"	"	"	46.13	17.27	15.22	5.47	2.22	1.36	0.82	162.3	121.8
	6 1/8	3 5/8	3 5/8	7/8	34.6	10.17	"	"	"	50.22	19.18	16.40	6.02	2.22	1.37	0.83	174.9	131.2
5	5	3 3/16	3 1/4	5/16	11.6	3.40	2	7/8	7/8	13.36	6.18	5.34	2.00	1.98	1.35	0.75	57.0	42.7
	5 1/16	3 1/4	3 5/16	3/8	13.9	4.10	"	"	"	16.18	7.65	6.39	2.45	1.99	1.37	0.76	68.2	51.1
	5 1/8	3 5/16	3 3/8	7/16	16.4	4.81	"	"	"	19.07	9.20	7.44	2.92	1.99	1.38	0.77	79.4	59.5
	5	3 7/32	3 1/4	1/2	17.9	5.25	"	"	"	19.19	9.05	7.68	3.02	1.91	1.31	0.74	81.9	61.4
	5 1/16	3 9/32	3 5/16	9/16	20.2	5.94	"	"	"	21.83	10.51	8.62	3.47	1.91	1.33	0.75	91.9	69.0
	5 1/8	3 11/32	3 3/8	5/8	22.6	6.64	"	"	"	24.53	12.06	9.57	3.94	1.92	1.35	0.76	102.1	76.6
	5	3 1/4	3 1/4	11/16	23.7	6.96	2 1/8	"	"	23.68	11.37	9.47	3.91	1.84	1.28	0.73	101.0	75.8
	5 1/16	3 5/16	3 5/16	3/4	26.0	7.64	"	"	"	26.16	12.83	10.34	4.37	1.85	1.30	0.75	110.3	82.7
	5 1/8		3 3/8	13/16	28.3	8.33	"	"	"	28.70	14.36	11.20	4.84	1.86	1.31	0.76	119.5	89.6
4	4	2 7/8	3 1/16	1/4	8.2	2.41	1 3/4	3/4	7/8	6.28	4.23	3.14	1.44	1.62	1.33	0.67	33.5	25.1
	4 1/16	2 15/16	3 1/8	5/16	10.3	3.03	"	"	"	7.94	5.46	3.91	1.84	1.62	1.34	0.68	41.7	31.3
	4 1/8	3	3 3/16	3/8	12.4	3.66	"	"	"	9.63	6.77	4.67	2.26	1.62	1.36	0.69	49.8	37.4
	4	2 31/32	3 1/16	7/16	13.8	4.05	1 7/8	"	"	9.66	6.73	4.83	2.37	1.55	1.29	0.66	51.5	38.6
	4 1/16	3 1/32	3 1/8	1/2	15.8	4.66	"	"	"	11.18	7.96	5.50	2.77	1.55	1.31	0.67	58.7	44.0
	4 1/8	3 3/32	3 3/16	9/16	17.9	5.27	"	"	"	12.74	9.26	6.18	3.19	1.55	1.33	0.69	65.9	49.4
	4	3 1/16	3 1/16	5/8	18.9	5.55	2	"	"	12.11	8.73	6.05	3.18	1.48	1.25	0.66	64.5	48.4
	4 1/16	3 1/8	3 1/8	11/16	20.9	6.14	"	"	"	13.52	9.95	6.65	3.58	1.48	1.27	0.67	70.9	53.2
	4 1/8	3 3/16	3 3/16	3/4	23.0	6.75	"	"	"	14.97	11.24	7.26	4.00	1.49	1.29	0.69	77.4	58.1
3	3	2 5/8	2 11/16	1/4	6.7	1.97	1 1/2	3/4	3/4	2.87	2.81	1.92	1.10	1.21	1.19	0.55	20.5	15.4
	3 1/16	2 11/16	2 3/4	5/16	8.4	2.48	"	"	"	3.64	3.64	2.38	1.40	1.21	1.21	0.56	25.4	19.0
	3		2 11/16	3/8	9.7	2.86	"	"	"	3.85	3.92	2.57	1.57	1.16	1.17	0.55	27.4	20.6
	3 1/16		2 3/4	7/16	11.4	3.36	1 5/8	"	"	4.57	4.75	2.98	1.88	1.17	1.19	0.56	31.8	23.8
	3		2 11/16	1/2	12.5	3.69	"	"	"	4.59	4.85	3.06	1.99	1.12	1.15	0.55	32.6	24.5
	3 1/16		2 3/4	9/16	14.2	4.18	1 3/4	"	"	5.26	5.70	3.43	2.31	1.12	1.17	0.56	36.6	27.4

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O. A. B. Co's Standard.
As Approved:- 10-14-09

J.A.A. 2-22-11